Remedial Investigation and Feasibility Study
Work Plan
Ruetgers-Nease Salem, Ohio Site

Volume 1: Work Plan
Volume 2: Quality Assurance Project Plan
Volume 3: Site Specific Sampling Plan
Volume 4: Health and Safety Plan

Revision 4:	February 28, 1990
Revision 3:	December 13, 1989
Revision 2:	August 3, 1989
Revision 1:	October 22, 1988

Submitted to

United States Environmental Protection Agency, Region 5
Hazardous Waste Enforcement Branch
230 S. Dearborn St.
Chicago, Illinois 60604

Ohio Environmental Protection Agency
Corrective Actions Section
Division of Solid and Hazardous Waste Management
1800 Watermark Dr.
Columbus, Ohio 43266

Northeast District Office
Division of Solid and Hazardous Waste Management
2110 Aurora Rd.
Twinsburg, Ohio 44087

Submitted by

Ruetgers-Nease
Chemical Company, Inc.
201 Struble Rd.
State College, Pennsylvania 16801

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1.0 INTRODUCTION

This Work Plan is the first of four documents that describe procedures that will be followed during field investigation activities at the Ruetgers-Nease Chemical Company, Inc., Salem, Ohio site. These investigations are part of a Remedial Investigation/ Feasibility Study (RI/FS) to be conducted at the site as required by an administrative order by consent (CO) and appended Statement of Work (SOW) with an effective date of February 26, 1988 by representatives of the U.S. Environmental Protection Agency (U.S. EPA), the Ohio Environmental Protection Agency (OEPA), and Ruetgers-Nease. This section of the Work Plan describes the purpose of the Work Plan and provides background information on site conditions.

1.1 Plan Purpose

The Work Plan (Volume I) is intended to provide an overview of the data gathering activities to be conducted at the site. This volume describes:

1. The contents of the site-specific support plans (Volumes 2-4) in which data collection, analysis, Quality Control/Quality Assurance, and health and safety procedures are detailed.

2. The project management structure under which activities will be conducted.

3. The planned phasing and duration of activities.

4. Data collection and analysis activities.

This volume is supported by the detailed activity descriptions provided in Volumes 2, 3, and 4. The remainder of Section 1.0 provides a brief history and background data for the Site.

This Work Plan outlines: 1) a remedial investigation which will constitute a complete Remedial Investigation (RI) to determine fully, the fact, nature, extent and magnitude of any release or threatened release of hazardous substances, pollutants or contaminants from the Ruetgers-Nease Chemical Company, Inc. (Ruetgers-Nease), Salem, Ohio site (the Site) and to gather all necessary data to support the Feasibility Study (FS); and 2) to perform a Feasibility Study to identify and evaluate alternatives for the appropriate extent of remedial action to achieve, in order to comply with applicable or relevant and appropriate requirements (ARARs), standards, limitations, criteria or goals and to prevent or mitigate the migration, release or threatened release of hazardous substances, pollutants, or contaminants from the Site.

1.2 Site Background and History

1.2.1 Location

The Site is located northwest of the City of Salem, Ohio in northern Columbiana County, near the border with Mahoning County (Figure 1-1). It is on the north side of State Route 14, west of Allen Road and is crossed by Conrail railroad tracks.

The Site is approximately 44 acres in size. It is surrounded by lightly developed land on three sides with an industrial plant (Crane-Deming Company) to the northeast. It is located on a topographic high, the axis of which runs southeast and northwest. The majority of the Site slopes to

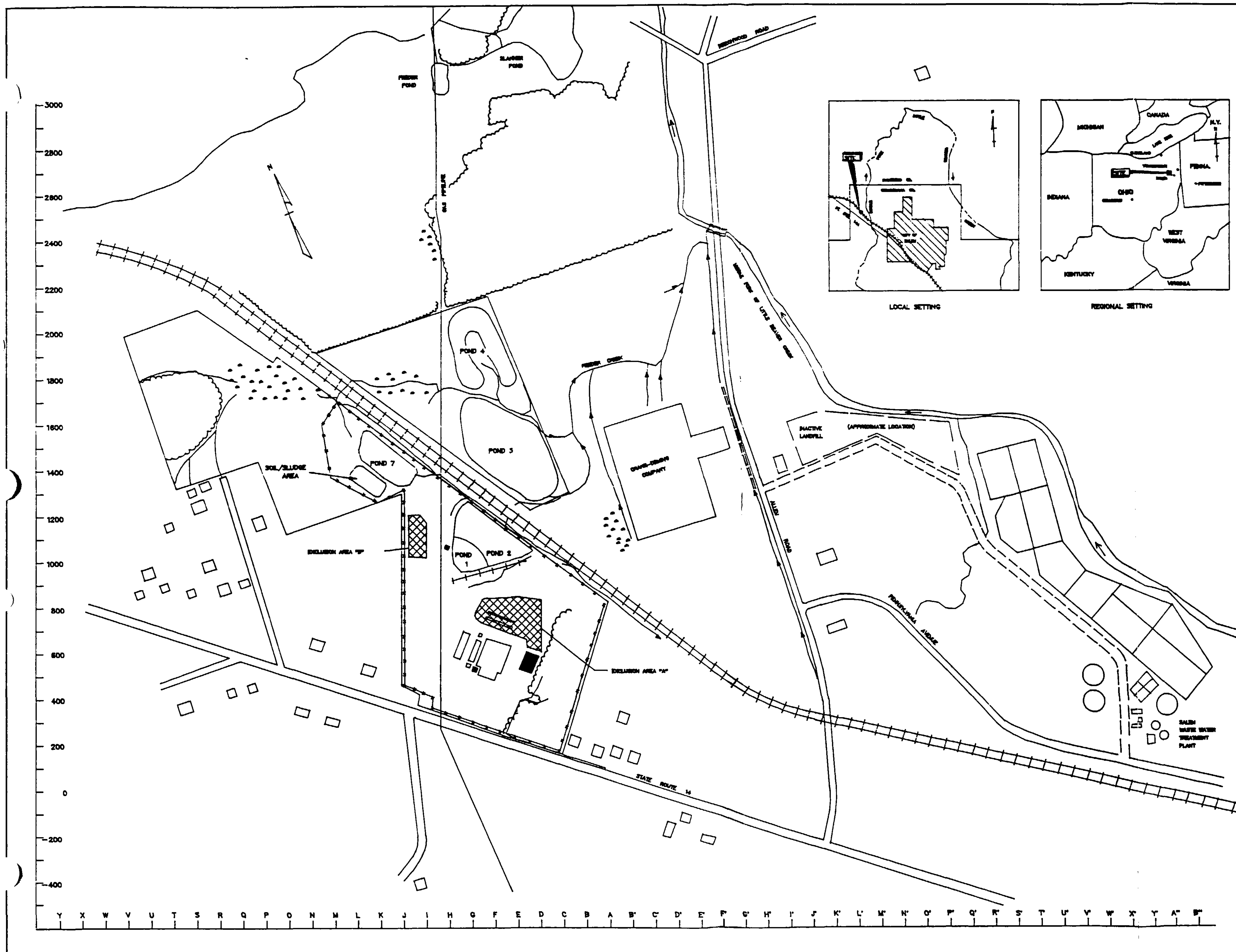

FIGURE WP 1 – 1

SITE LOCATION MAP

RUETGERS-NEASE SALEM SITE RI/FS

SCALE

0 200 400 600 (FEET)

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the northeast and drains to the Middle Fork of the Little Beaver Creek (MFLBC).

There is an inactive landfill located approximately 1,200 feet east of the site along the west bank of the MFLBC. This was operated as a dump and extended from the MFLBC to the east side of Allen Road. The area is presently covered with vegetation.

1.2.2 History

Prior to 1978, Nease Chemical Company (Nease) owned and operated a chemical manufacturing plant at the Site.

Manufacturing began in 1961. At various times during the period of 1961 through 1973, Nease produced a variety of chemical compounds including household cleaning compounds, fire retardants, pesticides and chemical intermediates used in agricultural, pharmaceutical, and other chemical products.

Products and chemical intermediates were produced in batch processes. Waste generated was neutralized and treated. Nease's waste handling facilities included air scrubbers and a multiple pond/settling tank system for neutralization and treatment of acidic waste. Five ponds (1, 2, 3, 4 and 7) were used for treatment and storage of either acidic plant waste or lime slurries from the neutralization of acidic wastes. After final settling, the neutralized liquid was discharged to the Salem City Wastewater Treatment Plant from the late 1960s to 1975. In addition, some drummed wastes were buried in Exclusion Area A. Manufacturing operations at this facility were discontinued in 1973. Following notification from OEPA of wastewater violations, Nease Chemical Company agreed in a Consent judgment in 1973 to discontinue manufacturing operations at the Site until such time as a new wastewater permit was obtained. Instead, Nease decided to close the facility. All of the buildings and manufacturing equipment on the Site, except for a warehouse and two small block buildings, were removed during decommissioning activities. The ponds were decommissioned by Nease in December 1975 pursuant to the 1973 Consent Judgment entered into between OEPA and Nease. As Pond 1 was drained, the liquid was neutralized and discharged to the Salem City Wastewater Treatment Plant. The pond was coated with agricultural lime and filled with soil borrowed from other areas on the facility.

Except for a small pool of water, Pond 2 was drained and the water was neutralized and discharged to the Salem City Wastewater Treatment Plant, in the same manner as Pond 1. Lime was applied to the remaining pool of water and sludge in the pond. Soil was borrowed from other areas of the Site and used to fill in the pond. Water from Pond 3 was discharged to the Salem City Wastewater Treatment Plant. The sludge in the pond had a viscosity too low to permit covering the pond with soil. Volunteer vegetation has stabilized the pond surface.

Water from Pond 4 was discharged to the Salem City Wastewater Treatment Plant. Because Pond 4 had little sludge in it, soil from the Crane-Deming property was used to cover this pond. Volunteer vegetation has stabilized the soil cover.

Water from Pond 7 was discharged to the Salem City Wastewater Treatment Plant. The sludge in the pond had a viscosity too low to permit covering the pond with soil. Since decommissioning, volunteer vegetation has stabilized the pond surface. In addition, desiccation has resulted in a decrease in volume of the residual material in the pond and solidification of the surface sludge. During plant operations, sludge and possibly soil were removed from Pond 7 and deposited in an area immediately to the southwest of Pond 7.

As of December 30, 1977, Nease's assets (including the Site) were acquired and it was merged with Ruetgers Chemicals, Inc. The new company resulting from the merger was Ruetgers-Nease Chemical Company, Inc.

In 1982 at the request of the OEPA, and continuing through 1986, Ruetgers-Nease conducted environmental investigations and remedial actions. The purpose of these investigations and studies was to define the hydrogeological conditions of the Site with regard to the potential migration of contaminants and to evaluate remedies to mitigate any pollution.

In 1983, the Site was placed on the National Priorities List (NPL).

By letter dated March 9, 1987 commenting on a proposed ground water restoration system submitted by Ruetgers-Nease, the OEPA and the U.S. EPA advised that Ruetgers-Nease would have to complete an RI and FS pursuant to a Consent Order. The OEPA and the U.S. EPA recognized that investigations have been conducted since 1982 and some remedial actions have been taken in the past.

This Work Plan outlines the tasks required to complete a RI/FS; and it provides a description of the facility as it currently exists, a history of significant events at the Site, a review of the environmental investigations both on-site and off-site conducted by Ruetgers-Nease and a summary of tasks to be conducted during the RI/FS.

1.2.3 Physiography

The Site is located in the Allegheny plateau physiographic province within glaciated terrain. The southern most edge of glacial deposits is approximately ten miles south of the Site. The regional physiography is a mature dissected bedrock plateau which has been smoothed by glacial erosion and mantled by glacial drift to depths of approximately 10 to 100 feet.

The region is drained by the MFLBC which originates southeast of the Site (Figure 1-1, page 3). From Salem, the MFLBC flows north for about five miles, then turns and flows southeastward to the Ohio River. The Site is located on a topographic divide between two small unnamed tributaries of the MFLBC. These two tributaries flow to the northeast until they join the MFLBC.

1.2.4 Glacial Geology

The Site is located on glacial deposits known as the Kent Moraine. The Kent Moraine forms a wide (5-15 miles), irregular, hummocky belt of nonhomogenous drift consisting of several successive sheets of Wisconsin Age till.

The Site is underlain by glacial drift varying in thickness from 10 to 25 feet. The wedge of glacial drift thickens to the east-northeast due to the presence of a glacially-scoured bedrock valley in the area of the MFLBC. Typically, the till in the study area consists of silty or sandy gray-blue plastic clay with some pebbles and a few boulders. Except for sand and gravel deposits, the till material has a low permeability.

1.2.5 Valley Fill

The formation of the Valley Fill is a result of glacial erosion and deposition. Prior to the deposition of glacial drift, glacial forces eroded the underlying sedimentary rocks forming a valley in the bedrock. This eroded valley was later filled with the glacial drift. According to the Ohio Department of Natural Resources (ODNR), glacial fill within the valley contains discontinuous bodies of sand and gravel of limited thickness and extent. Wells within the Valley Fill that do not encounter permeable sands and gravels must be drilled into the underlying bedrock to obtain an appreciable water yield. (Ohio Department of Natural Resources, Division of Water, 1978.) Prior drilling performed by Ruetgers-Nease in the Valley Fill verified the presence of sand and gravels separated by clay.

1.2.6 Bedrock Geology

The unconsolidated material is underlain by interbedded sandstones, shales and coals of the Pennsylvanian Age Allegheny formation. A generalized cross-section is presented as Figure 1-2. Sandstones of the Oak Hill member comprise the uppermost bedrock aquifer. The Lower Kittanning No. 5 member (coal and claystone) are stratigraphically below the Oak Hill member. Stratigraphically below the Kittanning No. 5 member is the Kittanning member. The Kittanning member contains a larger percentage of silt-sized materials than does the coarser-grained Oak Hill member. Within the Oak Hill and the Kittanning members are the two aquifers found in the bedrock.

1.2.7 Hydrogeology

The present study area contains identifiable aquifers with ground water occurring under unconfined and confined

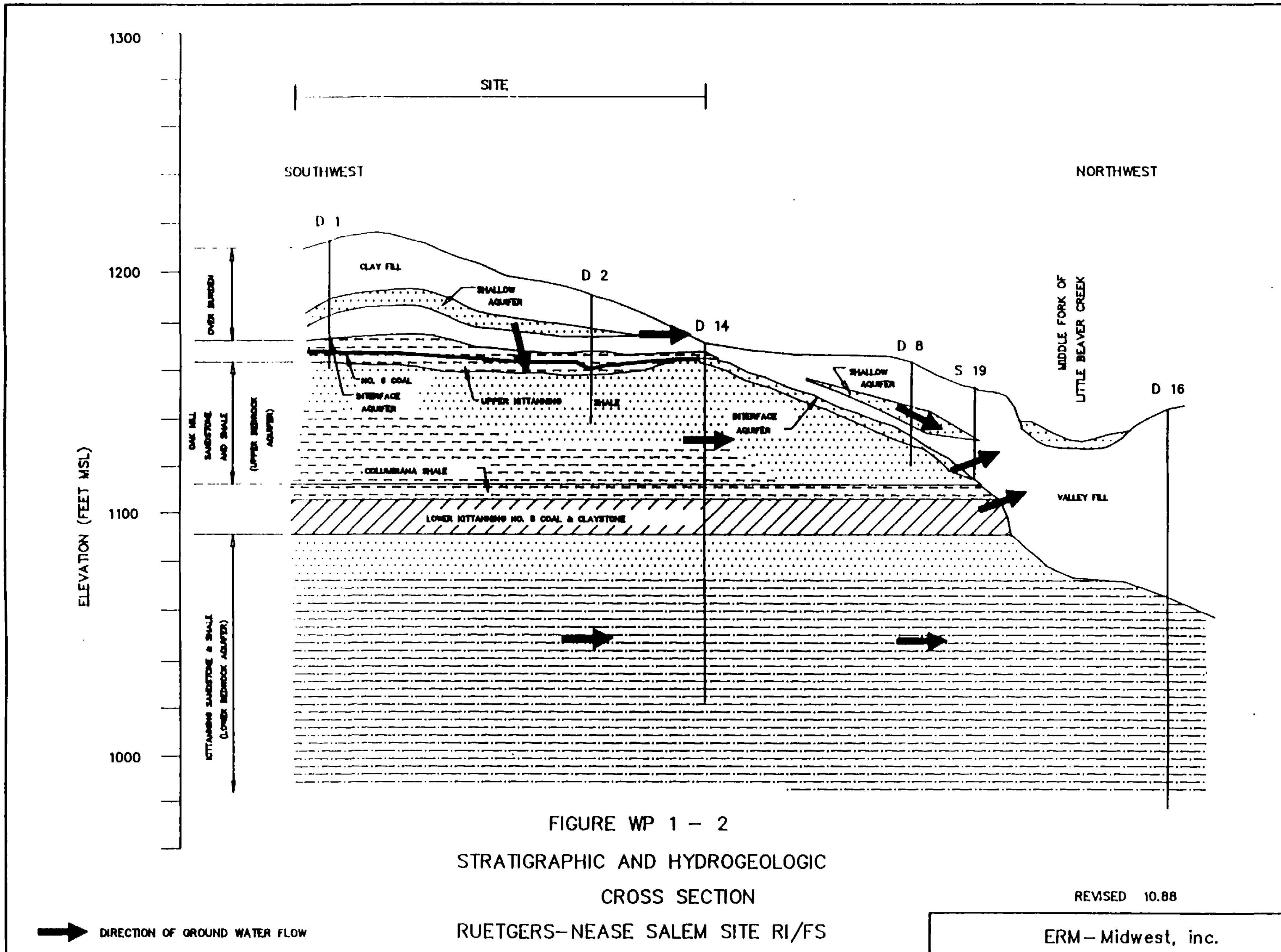

FIGURE WP 1 – 2

STRATIGRAPHIC AND HYDROGEOLOGIC CROSS SECTION

RUETGERS–NEASE SALEM SITE RI/FS

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conditions. Near the MFLBC, artesian conditions may be found. The distinct aquifers that occur under the Site or within the present study area are: the Shallow Aquifer, the Interface Aquifer, the Upper Bedrock Aquifer, the Lower Bedrock Aquifer, and the Valley Fill Aquifer. The Valley Fill Aquifer will be investigated and delineated as part of this course of work. The detailed studies conducted over the last five years by Ruetgers-Nease, including the installation of 38 wells, geophysical surveys, and a pump test, have confirmed a complex hydrogeologic system.

The Shallow Aquifer system is discontinuous, consisting of several types of sands in the unconsolidated till. These sands range from thin sand and gravel stringers under the Site to possibly a sheet sand east of Allen Road. Ground water occurs under unconfined conditions under the Site and may become confined east of Allen Road. Ground water in the Shallow Aquifer generally flows in the direction of the MFLBC.

The Interface Aquifer consists of sands and gravels between the bedrock surface and the overlying till. It has a variable thickness and distribution. In the Interface Aquifer, ground water occurs under unconfined conditions under the Site and flows in the direction of the MFLBC where it may become confined east of Allen Road.

The Upper Bedrock Aquifer (Oak Hill sandstones) is a fine to medium grained, gray sandstone that increases in thickness from the Site to the east, but has been removed by erosion west of the MFLBC. Under the Site, a shale bed with a coal seam separates the Interface and Shallow Aquifers from the Upper Bedrock Aquifer. This shale may act as a leaky confining layer. Ground water flow in the Upper Bedrock Aquifer is predominantly in the direction of the MFLBC.

The Lower Bedrock Aquifer (Kittaning sandstones) is separated from the Upper Bedrock Aquifer by the Lower Kittanning Claystone (underlay) and consists of interbedded siltstone, sandstone and shale. The Lower Bedrock Aquifer ground water flows to the east.

According to ODNR, the unconsolidated deposits in the Valley Fill may be as much as 140 feet thick. This glacial drift contains discontinuous bodies of sand and gravel that may yield 10 to 30 gallons per minute (gpm). Wells within the Valley Fill that do not encounter permeable sands and gravels must be drilled into the underlying bedrock to obtain an appreciable water yield (Ohio Department of Natural Resources, Division of Water, 1978). According to the ODNR 1978 report, the closest well through the Valley Fill is located north of the Beechwood Road extension and west of the MFLBC; or approximately 0.7 of a mile northeast of the Site. Bedrock in this well was encountered at 125 feet, and the well was completed 15 feet into bedrock. The water bearing formation encountered was reported as a sandstone and the reported yield was 8 gpm. The reported water bearing zone (i.e., the sandstone bedrock), the depth of the well, and the low yield indicates that a Valley Fill Aquifer may not be present at this location. Prior drilling performed by Ruetgers-Nease in the Valley Fill has verified the presence of clay, sand and gravel. The Valley Fill Aquifer will be further delineated as part of this course of work about the study area.

1.3 Nature and Extent of The Problem

1.3.1 Sources

Contamination of affected media on-site or off-site is linked to sources as follows:

1. Buried drums in Exclusion Area A (drums have been removed by Ruetgers-Nease during previous remedial actions) contained volatile organic and non-volatile organic substances. Most drums displayed various degrees of oxidation and penetration. Leakage from these drums allowed migration of contained organics.

2. Chemical spills in Exclusion Areas A and B and possibly some other manufacturing areas of the Site over the period of plant operation contaminated portions of the surface and subsurface soils in these areas (over 6,000 cubic yards of contaminated soils have been removed by Ruetgers-Nease during previous remedial actions and disposed of at a permitted facility off-site). There is evidence of past migration of soils off the Site.

3. Treatment/disposal Ponds 1 and 2 where wastewater was stored had unlined/nonsecure bottoms which allowed the migration of volatile organic substances into various previously described aquifers and surface waters. In late 1983, approximately 2,800 cubic yards of contaminated soils were excavated by Ruetgers-Nease from Pond 1 and disposed of at a permitted facility off-site.

4. Disposal Ponds 3, 4 and 7, which contain neutralized calcium sulfate sludge, have unlined bottoms which may allow some migration from the ponds.

Hazardous materials exist at the Site. Table 1-1 lists those compounds that have been detected at the Site by Ruetgers-Nease.

WP TABLE 1-1

COMPOUNDS THAT HAVE BEEN QUALITATIVELY IDENTIFIED
AT THE RUETGERS-NEASE SALEM SITE PRIOR TO THE RI/FS

Compounds	Range of MDLs Solid	Range of MDLs Aqueous
1,1-Dichloroethene	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
1,2-Dichloroethene	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
Chloroform	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
1,2-Dichloroethane	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
1,1,1-Trichloroethane	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
1,2-Dichloropropane	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
1,3-Dichloropropene	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
Trichloroethene	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
Benzene	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
Tetrachloroethene	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
1,1,2,2-Tetrachloroethane	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
Toluene	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
Chlorobenzene	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
Ethylbenzene	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
o,m,p-Xylene	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
1,3+1,2-Dichlorobenzene	50-100 ug/kg[1]	0.5-1.0 ug/L[1]
Methoxychlor	50 ug/kg[2,3]	0.005 ug/L[2]- 0.05 ug/L[3]
Mirex	50 ug/kg[2,3]	0.005 ug/L[2]- 0.05 ug/L[3]
3,4-Dichloronitrobenzene	500 ug/kg[3]- 1000 ug/kg[1]	50 ug/L[3]- 200 ug/L[1]
Diphenyl Sulfone	500 ug/kg[3]- 1,000 ug/kg[1]	50 ug/L[3]- 200 ug/L[1]

NOTES

MDL - Method Detection Limit

[1]By GC/FID

[2]By GC/ECD

[3]By GC/MS(SIM)

A total of 115, 55-gallon steel and fiber drums containing hazardous waste and over 9,500 cubic yards of contaminated soil were removed from the Site in 1983. The exact amount of sludge material remaining at the Site is not known at present; however, calcium sulfate sludge thickness in Ponds 3 and 7 ranges from about three to six feet. Sludge residue in Pond 4 has been covered with clean soil and the total volume cannot presently be accurately quantified.

Affected media at and adjacent to the Site include soil, sediment, surface water, ground water, and possibly air.

1.3.2 Pathways and Extent of Contamination Migration

Past Ruetgers-Nease investigations have determined that ground water is affected primarily by volatile organics from Ponds 1 and 2, and, secondarily, from Exclusion Area A.

Contaminants are moving from the areas of Ponds 1 and 2 and concentrations of contaminants occur in the central areas of the plumes in the upper three aquifers. Downward migration from the Upper Bedrock Aquifer may be inhibited by the Lower Kittanning Claystone.

Besides ground water, other potential pathways include the two on-site water supply wells (P1 and P2), sheet run-off containing dissolved and particulate materials from the Site, and air transport of particulates. Ponds 3, 4, 7, the sludge/soil area southwest of Pond 7; Exclusion Area B; and infiltration of contaminants from soil may also be pathways of contaminant migration.

Water supply wells P1 and P2 are cased to the bedrock, and completed as open holes to approximately 220 feet and 330 feet, respectively. These water supply wells may be responsible for possible cross-contamination of the aquifers, and will be sealed by Ruetgers-Nease.

Sheet run-off during precipitation events has the potential for transporting dissolved materials and sediments on-site to drainage ways and ultimately into the MFLBC where they could be transported further downstream.

Fugitive particulate and volatile emissions into the air have the potential to be transported off-site.

1.4 History of Response Actions

As a result of the Ruetgers-Nease program for remediating contamination at the Site, a series of actions have been taken by Ruetgers-Nease in the past several years. These actions were taken when specific source areas of contamination were defined.

1.4.1 Previous Environmental Investigations

In July 1982, Ruetgers-Nease submitted to the OEPA a description of manufacturing chemistry for products produced at Salem. In September of that year Ruetgers-Nease submitted a plan to the OEPA to conduct a general environmental assessment of the Site. The objectives of the assessment were to determine whether previous plant operations had impacted soils, surface water, sediments, and ground water at the Site, and to investigate the possible existence of buried drums. A detailed plan was submitted to the OEPA in October 1982. After review and comment of the plan by the OEPA, Ruetgers-Nease, in the fall of 1982, drilled soil borings and deep and shallow monitoring wells, conducted geophysical investigations and collected samples of surface water, soil and sediment. Progress reports describing implementation of the plan were submitted by Ruetgers-Nease to the OEPA in January 1983.

Fifty-six soil borings ranging in depth from 4 to 24 feet were drilled into the glacial drift on-site. Samples were collected at 0 to 6 inches, 2 to 4 foot, and 6 to 8 foot intervals. The borings provided information regarding the composition of the drift, and indications of contamination. This information was augmented by logs of ten borings completed by the Crane-Deming Company in 1970, before the construction of their facility.

Eleven shallow wells and six deep wells were drilled into the glacial drift and bedrock of the area to define both the glacial and bedrock geology, identify aquifers, and identify pathways of contaminant migration.

Several magnetic surveys were run in the exclusion areas to indicate possible locations of buried drums. These surveys were followed by the excavation of test pits to confirm locations of buried drums.

Surface soil, sediment and water samples were collected by Ruetgers-Nease to characterize conditions on and adjacent to the Site. Eleven sediment and eight water samples were collected in 1982 from freshwater ditches along the drainageways and in the MFLBC. Seventy-three depth discrete soil samples (1-12") were collected at 28 locations in the swamp behind Crane-Deming, and adjacent to both Exclusion Areas.

In the fall of 1983, Ruetgers-Nease installed an additional five shallow wells and three deep wells. Ruetgers-Nease also collected depth discrete and composite surface soil samples during remediation activities to better define the extent of contamination in both Exclusion Areas and the disposal ponds. Samples were taken at 68 locations before and after specific remedial actions. Eighteen sediment and six surface water samples were collected at this time from the MFLBC.

In February and March 1984, one shallow well and four deep wells were installed. During July and August of 1984, an additional shallow well and three deep wells were installed along with two test wells designed to investigate the hydraulic properties of the Upper Bedrock Aquifer and the Shallow Aquifer. A 48-hour pump test was performed by Ruetgers-Nease at test well T2 in December, 1984. The purpose of this test was to quantify the hydraulic conditions in the vicinity of Pond 2 in the Upper Bedrock Aquifer, determine the area of influence of the test well for evaluating its potential as a contaminant recovery well, and determine any hydraulic connection between the Upper Bedrock Aquifer and surrounding aquifers.

In December of 1985, 11 borings were drilled within Pond 2 to investigate the quantity, geometry and chemical characteristics of the fill/sludge material. A twelfth boring was drilled on the perimeter of the pond to investigate the quality of material outside the pond. In February and March of 1986, an additional shallow well and an additional deep well were installed to further define water quality in the Interface and Upper Bedrock Aquifers near the MFLBC. In February and March, 1986, three borings were drilled in the overburden around the Crane-Deming property and east of Dunlop Disposal to better define the Interface Aquifer geometry in this area.

Ruetgers-Nease collected additional samples from the MFLBC in 1985 and the OEPA collected fish, sediment, surface water and benthic organism samples in 1985. The U.S. EPA and the OEPA collected fish samples, sediment samples, and samples of benthic organisms from the MFLBC between August and November 1987.

Several rounds of ground water sampling have been carried out since the initial round in 1982. Ground water samples were collected by Ruetgers-Nease in December 1982, April, September and December 1983, February and July 1984, and January, May and December 1985. Wells S19 and D17 were sampled in April 1986. All wells were sampled in March 1987. Private water wells were sampled by the OEPA in September/October 1983, February 1984, February 1985, and August 1986.

These activities, results and evaluations were described in a number of plans and reports including:

1. Environmental Assessment of the Ruetgers-Nease Chemical Company, Inc. Salem, Ohio Site Phase 1 Report, submitted April 30, 1984 to the OEPA and the U.S. EPA, and revised September 19, 1984.

2. Environmental Assessment of the Ruetgers-Nease Chemical Company, Inc. Salem, Ohio Site Phase 1B Report, submitted July 1985 to the OEPA and U.S. EPA.

3. Pond 2 Boring Report, submitted April 3, 1986 to the OEPA and the U.S. EPA.

4. Risk Assessment for Ruetgers-Nease Chemical Company Facility, Salem, Ohio, submitted September 15, 1986 to OEPA and U.S. EPA.

5. Ground Water Restoration System at Ruetgers-Nease Chemical Company, Inc. Salem, Ohio Site, submitted September 29, 1986 to OEPA and U.S. EPA.

6. Hydrogeologic Conditions at the Ruetgers-Nease Chemical Company Site, Salem, Ohio, submitted September 1986 to OEPA and U.S. EPA.

7. Copy of Analytical Lab Sheets and Cards 1983-1986 submitted to OEPA.

The above outlined environmental actions, which were done without a formal Consent Order, were performed at the request of and were monitored by the OEPA. After the conduct of additional RI work to characterize the fact, nature, extent and magnitude of chemical contamination that relates to the Site, the utility and use of the above environmental work will be evaluated by the U.S. EPA and the OEPA.

1.4.2 Previous Remedial Actions

Since 1983, Site conditions have changed as a result of Ruetgers-Nease's remediation efforts. For example, soils from Exclusion Areas A and B and drums from Exclusion Area A have been removed, soils/sludges from Pond 1 have been removed, and a leachate collection system has been installed. These actions have influenced the investigation activities conducted previously, and will impact those to be conducted as described in this SOW.

Ruetgers-Nease initially proposed Site remediation in a plan submitted to the OEPA on March 12, 1983. The plan indicated a two-phased approach as follows:

1. Phase 1 would include: the removal of drums and associated contaminated soils from Exclusion Area A; and the removal of soil from an area which was barren of vegetation, indicated as Exclusion Area B.

2. Phase 2 would be implemented upon completion of Phase 1, and would include: assessment of surface water, ground water, soil and sediment contamination.

Response to the plan was submitted to Ruetgers-Nease by the OEPA in letters dated July 5, 1983 and July 6, 1983. The July 5, 1983 letter addressed the drum and contaminated soil portions of the plan. In response, Ruetgers-Nease submitted a detailed implementation plan for soil and drum removal to the OEPA on July 25, 1983 (revised September 1, 1983). The soil and drum removal implementation plan was accepted by the OEPA by letter on September 15, 1983.

In the fall of 1983, Ruetgers-Nease performed the Phase 1 Site work described above, and implemented various steps to control soil erosion at the Site. These initial clean-up activities were directed primarily at the two designated Exclusion Areas. Fifty-four hundred (5,400) cubic yards of contaminated soil were removed from Exclusion Area A and six hundred and eighty-four (684) cubic yards were removed from Exclusion Area B. In addition, Ruetgers-Nease excavated twenty-seven hundred ninety (2,790) cubic yards of contaminated soils from Pond 1 and six hundred and thirty (630) cubic yards from a freshwater ditch parallel to the south side of the main railroad line. All of the contaminated soil was disposed of at Wayne Disposal, Inc. of Dearborn, Michigan, a permitted hazardous waste disposal facility.

Fiber drums and some steel drums found in Exclusion Area A that were in poor condition were disposed of with the contaminated soil. A total of one-hundred fifteen (115) intact drums were separately removed. Several of these drums were found to be empty and were also disposed of with the contaminated soil. One hundred and one (101) drums were overpacked, stored in the warehouse, opened and sampled. These drums were removed from the Site for disposal at Wayne Disposal and Ross Incineration Services, Grafton, Ohio (a permitted hazardous waste facility). Following the removal of soil and drums from Exclusion Area A, a metal detector survey and exploratory backhoe pits found no additional buried drums.

There is concern that contaminated sediments can leave the Site during and after precipitation events. In response to the concern about contaminated sediments leaving the Site and to prevent or minimize soil erosion and contaminant migration, a number of steps were taken which included seeding of Pond 2 to establish a grass ground cover; installation of geotextile fabric barriers across drainage swales and fresh water ditches; installation of rock dams; and installation of hay-bale barriers around the Exclusion Areas. Current conditions may be allowing contaminated soils and sediments to migrate off-site.

A leachate collection system was also installed on the south side of the railroad tracks below Exclusion Area A to mitigate the migration of ground water seepage. This leachate is being disposed of on a regular schedule at DuPont Chambers Works in Deepwater, New Jersey, a permitted waste treatment facility.

These remedial actions removed some significant sources of contaminants from the Site.

2.0 WORK PLAN OBJECTIVES AND SCOPE

2.1 Project Objectives

The objectives of this RI/FS study are: (1) to determine the nature and extent of contamination and the degree that any may exist on and off-site, (2) to identify potential contaminant pathways, (3) develop an endangerment assessment, identify receptors and quantify and qualify the risk associated with various remedial alternatives including the no-action alternative, and (4) to develop, screen, evaluate, and recommend the most cost-effective remedial actions. The available site-specific data to meet these objectives has been judged by U.S. EPA and OEPA to be insufficient; therefore a field investigation study will be performed to define the nature and extent of contamination.

2.2 Project Scope

The RI/FS project scope for the Ruetgers-Nease Chemical Company Site has been developed to address the specific project objectives described in Section 2.1, and to meet the requirements of the Consent Order. To accomplish these goals, a series of activities have been designed which are identified through an interrelated series of tasks and subtasks. A detailed outline of the tasks and subtasks for this RI/FS project is presented in the approved RI/FS SOW. The following is a brief overview of the scope of the project.

Task 1, the description of background information, has essentially been completed, and is presented in the approved RI/FS Statement of Work (SOW) document. Task 2 is an investigation planning and scoping activity, the result of which is this RI/FS Work Plan. Task 3, the site investigation, is a significant data gathering effort which involves numerous on and off-site investigative and sampling activities. The procedures and specifications presented in this Work Plan document and attachments describe the activities associated with the site investigation task.

Task 4, the Site Investigation Analysis, will consist of a thorough analysis and summary of the results of all quality assured data collected during the Task 3 Site investigation. The objective of this task will be to ascertain if the investigation data are sufficient in quality and quantity to support an endangerment assessment (EA) of the Site, an ATSDR health assessment, and an FS.

Task 5, Remedial Investigation Reports, will encompass and address all data and progress reporting needs during the RI. Included in Task 5 will be the preparation and submission of monthly progress reports, a draft Remedial Investigation Report, and a final Remedial Investigation Report to the OEPA and U.S. EPA Region 5.

Task 6, Remedial Alternatives Screening, will consist of the following increasingly rigorous series of development and screenings of remedial alternatives:

Preliminary Remedial Technologies: A master list of potentially feasible technologies will be developed. These technologies will include both on-site and off-site remedies, depending on Site problems. The master list will be screened based on Site conditions, waste characteristics, and technical requirements.

Development of Alternatives: Based on the results of the remedial investigation and consideration of preliminary remedial technologies, a limited number of alternatives will be developed which are based on objectives established for the response.

Initial Screening of Alternatives: The alternatives developed under the preceding subtask will be subjected to an initial screening to narrow the list of potential remedial actions for the detailed analysis. The rationale for eliminating an alternative will be included.

For the purpose of obtaining ARARs from the State of Ohio, a detailed description of alternatives will be prepared following the initial screening of alternatives which will include the extent of remediation, contaminant levels to be addressed, and method of treatment.

Alternatives undergoing the detailed analysis during performance of Task 6 may require, as appropriate, additional field investigations to obtain the necessary data for further evaluation of site characteristics and alternatives. Laboratory and bench scale studies may be necessary as part of this subtask.

Task 7, the Remedial Alternatives Evaluation, will consist of a detailed evaluation, and comparison of the alternatives that remain after Task 6. The alternatives will be evaluated against the broad factors of effectiveness, implementability, and cost using appropriate and more specific component measures such as protectiveness, compliance with applicable or relevant and appropriate requirements, reliability, and technical feasibility. The detailed analysis of each alternative shall include both short-term and long-term considerations for effectiveness, implementability, and cost.

The alternatives will be compared to each other using the full array of evaluation factors appropriate at the Site, as is detailed in the RI/FS Statement of Work.

Identification and description of action-specific Federal and State of Ohio ARARs and other criteria, advisories and guidance to be used in the analysis and selection of a remedy will be identified. Alternatives will be analyzed in sufficient detail so that the remedies can be selected from a set of defined and discrete hazardous waste management approaches.

Task 8 will encompass the preparation of a Feasibility Study Report. A draft Feasibility Study Report will be prepared and submitted to the OEPA and the U.S. EPA for approval. The Report will include the results of Tasks 6 and 7 with appropriate and relevant supporting information included in Appendices. The final Feasibility Study Report will then be submitted following approval of the draft Feasibility Study Report in accordance with the Consent Order.

3.0 CONTENTS OF SITE SPECIFIC SUPPORT PLANS

There are three (3) plans in addition to this Work Plan (Volume 1) that together constitute the site specific support plans for the Salem RI/FS: the Quality Assurance Project Plan, Volume 2 (QAPP); the Site Specific Sampling Plan, Volume 3 (SSSP); and the Site Health and Safety Plan, Volume 4 (HSP). The Plan to Satisfy Permit Requirements (PSPR), required under the C.O. is attached to this volume as Section 13.0.

The plans contain the following information:

3.1 Volume 2: Quality Assurance Project Plan (QAPP)

The QAPP contains the following information:

1.0 TITLE PAGE
2.0 TABLE OF CONTENTS
    2.1 List of Figures
    2.2 List of Tables
3.0 PROJECT DESCRIPTION
    3.1 Site Background and History
        3.1.1 Location
        3.1.2 History
        3.1.3 Existing Conditions
    3.2 Problem Statement
        3.2.1 Sources
        3.2.2 Affected Media
    3.3 Project Objectives
    3.4 Time Schedule
        3.4.1 ERM's Time Schedule
        3.4.2 Enseco's Time Schedule
    3.5 Intended Data Use

Attachments

3.2 Volume 3: Site Specific Sampling Plan (SSSP)

3.3 Volume 4: Site Health and Safety Plan (HSP)

4.0 PROJECT MANAGEMENT

This section describes the organization established to conduct the Salem RI/FS and the specific responsibilities of individuals assigned to the project. Reporting requirements and management procedures specific to this project are discussed.

4.1 Organization

Eight (8) separate organizations will be involved in completing the majority of RI/FS activities. They include:

1. Ruetgers-Nease Chemical Company, Inc. (Ruetgers-Nease).

2. ERM-Midwest Inc., which will complete most RI/FS activities. ERM-Midwest, Inc. will be supported by Environmental Standards, Inc., which will be utilized for an independent validation of analytical data.

3. The Enseco Inc. (ERCO, CAL Analytical Labs, and CRL/El Monte) which will provide chemical analysis services during the RI/FS. Enseco will be supported by Goldberg, Zoino and Associates, Inc. (GZA), which will provide soil physical testing services as subcontractor to Enseco.

4. John Mathes and Associates Drilling Company, which will provide well drilling and installation, and soil boring services.

5. ERM, Inc., which will perform fish sampling and identification services.

6. ERM-Southeast, Inc., which will perform all air sampling.

7. ENVIRON Corporation, which will conduct Endangerment Assessment and Risk Assessment activities.

8. U.S. EPA Region 5 and OEPA.

In addition, minor subcontractors may be used to provide various support services (i.e., plumbing, electrical, road building).

Figure 4-1 illustrates the project team structure.

4.2 Responsibilities

The responsibilities of the project team are described below.

4.2.1 Project Coordinator

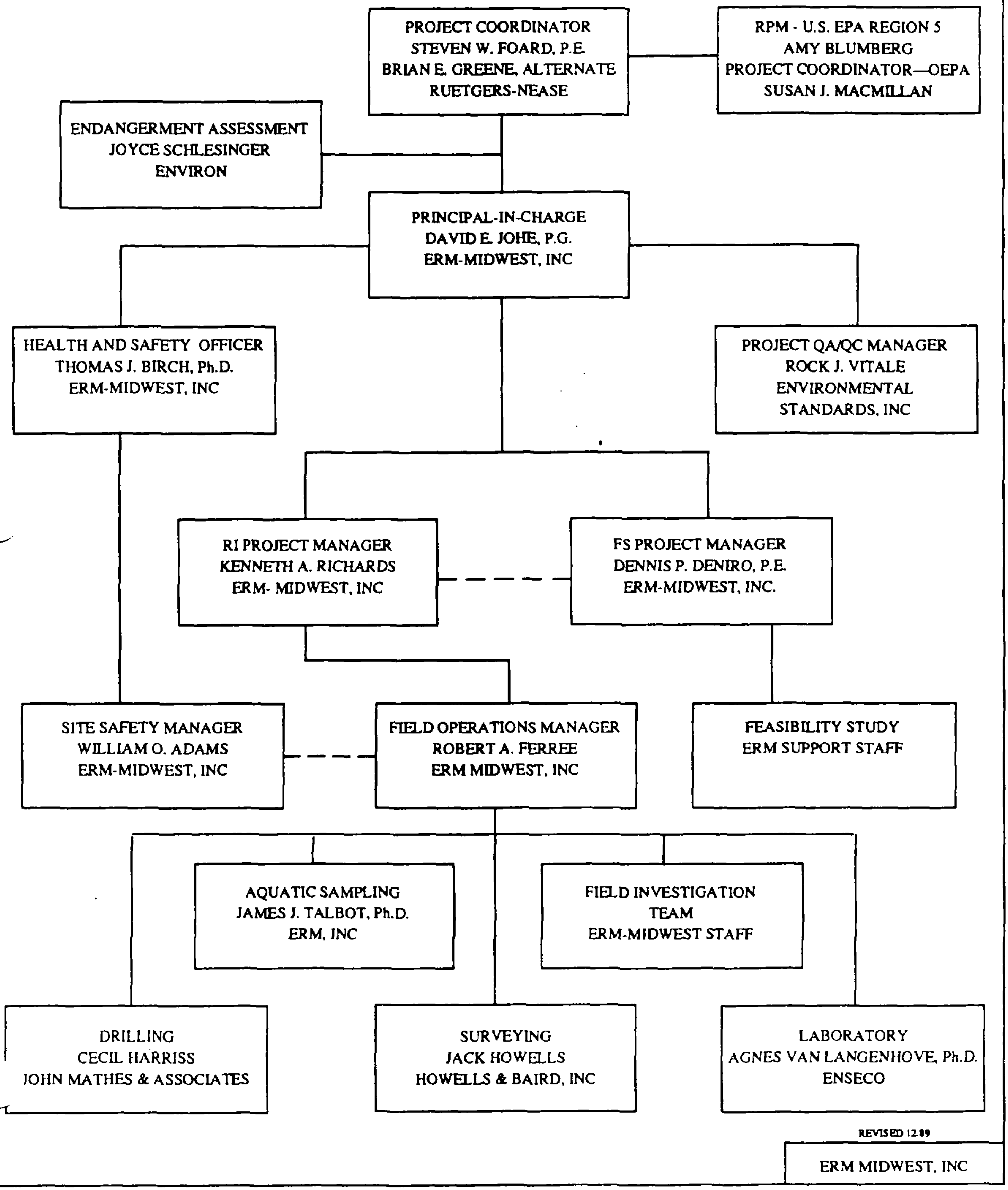
Steven W. Foard, P.E. of Ruetgers-Nease is the Project Coordinator for this RI/FS. The alternate Project Coordinator is Brian E. Greene of Ruetgers-Nease. The Project Coordinator responsibilities include:

1. Providing an interface with the U.S. EPA/OEPA, the Principal-in-Charge, and the Project Manager.

2. Approving all project activities.

FIGURE WP 4-1

FIELD INVESTIGATION/REMEDIAL STUDY ORGANIZATION
RUETGERS-NEASE SALEM SITE RI/FS



3. Initiating plan modification requests.

4. Ensuring that the terms of the Consent Order and SOW are met.

4.2.2 Principal-in-Charge

The Principal in Charge for this investigation is David E. Johe, of ERM-Midwest. The responsibilities of the Principal-in-Charge include:

1. Providing an interface with the Project Coordinator and the Project Manager.

2. Committing ERM-Midwest resources necessary to perform the RI/FS.

3. Coordinating the technical direction for the project.

4. Approving all ERM-Midwest project deliverables.

4.2.3 Project Managers

Kenneth A. Richards of ERM-Midwest is the Project Manager for the RI, and Dennis P. DeNiro of ERM-Midwest will be the Project Manager for the FS investigation. The responsibilities of the Project Manager include:

1. Providing an interface with the Project Coordinator and the Site Manager.

2. Implementing project plans.

3. Managing and coordinating project activities.

4. Managing and coordinating project personnel and staffing.

5. Managing project deliverable completion.

6. Providing input to the Principal-in-Charge on technical direction.

4.2.4 Project Quality Assurance Manager

Rock J. Vitale of Environmental Standards is the Quality Assurance Manager for this investigation. The Quality Assurance Manager is responsible for review and validation of all data, (i.e.,analytical, field, and geotechnical) and project deliverables in accordance with the QAPP. After analytical data have been vigorously reviewed, data will be submitted to the U.S. EPA and OEPA Quality Assurance Managers for review and approval.

4.2.5 Health and Safety Officer

Thomas J. Birch, Ph.D, of ERM-Midwest, is the Health and Safety Officer for this investigation. The responsibilities of the Health and Safety Officer include:

1. Monitoring on-site hazards and conditions.

2. Monitoring the effectiveness of the Health and Safety Plan.

3. Selecting proper clothing and equipment to ensure the safety of on-site personnel.

4. Confirming each field team member's suitability for work based on a physician's recommendation.

4.2.6 Field Operations Manager

Robert A. Ferree of ERM-Midwest will be the Field Operations Manager for this investigation. The responsibilities of the Field Operations Manager include:

1. Overseeing the implementation of the Work Plan and SSSP.

2. Maintaining communications with the Project Manager and the Health and Safety Officer.

3. Directing field activities.

4. Monitoring investigation progress.

4.2.7 Drilling Manager

John Mathes and Associates Drilling will be responsible for providing equipment, materials and personnel necessary to install monitoring wells and complete soil borings under the direction of ERM-Midwest.

4.2.8 Laboratory Manager

Agnes Van Langenhove, Ph.D. of Enseco will be responsible for providing equipment, materials and resources to complete chemical and physical analysis of samples collected during the RI/FS, under the direction of ERM-Midwest.

4.2.9 Endangerment Assessment/Risk Assessment Manager

Joyce Schlesinger, P.E., a principal of ENVIRON Corporation, will be responsible for completing the Endangerment Assessment activities conducted during the RI/FS, under the direction of Ruetgers-Nease.

4.2.10 U.S. EPA Remedial Project Manager and OEPA Project Coordinator

Amy Blumberg is Remedial Project Manager for U.S. EPA Region 5, and Susan MacMillan is the OEPA Project Coordinator for this RI/FS. Their responsibilities include:

1. Technical review and approval of all plans and data submitted as part of the RI/FS.

2. Coordination of RI/FS activities with the Project Coordinator.

3. The U.S. EPA Project Coordinator shall have the authority vested in an On-Scene Coordinator and a Remedial Project Manager (OSC, RPM) by the National Contingency Plan, 40 CFR Part 300, as amended, including the authority as provided therein to halt, conduct, or direct any work required by this Consent Order, or to direct any response action undertaken by the U.S. EPA when conditions at the Facility may present an imminent and substantial endangerment to the public health or welfare or the environment.

4.2.11 U.S. EPA Region 5 Quality Assurance Manager

Valerie Jones will be the Quality Assurance Manager (QAM) for U.S. EPA Region 5. Responsibilities of the QAM include the final approval of data produced as part of this RI/FS. In addition, the QAM may provide data validation.

4.2.12 U.S. EPA Region 5 Contract Project Management

The U.S. EPA Region 5 Contract Project Management will be responsible for the general oversight of the RI/FS with respect to contractual and/or legal obligations.

4.3 Reporting

Notices of commencement of sampling activities, personnel changes, and force majeures; monthly progress reports; and dispute resolution will be reported to the U.S. EPA and the OEPA. Reports will be prepared by the Project Coordinator, with input from other Project Team members.

Reports shall be sent by certified mail as follows:

1. Documents to be submitted to the U.S. EPA:

   U.S. Environmental Protection Agency
   Region 5
   Hazardous Waste Enforcement Branch
   230 South Dearborn Street (5HE-12)
   Chicago, IL 60604
   Attn: Amy Blumberg, Nease Chemical RPM

2. Documents to be submitted to the OEPA:

   Ohio Environmental Protection Agency
   Division of Solid and Hazardous Waste Management
   Northeast District Office
   2110 Aurora Road
   Twinsburg, OH 44087
   Attn: Susan MacMillan

   Ohio Environmental Protection Agency
   Corrective Actions Section
   Division of Solid and Hazardous Waste Management
   P. O. Box 1049
   1800 Watermark Drive
   Columbus, OH 43266-1049
   Attn: Supervisor Technical Support Unit

Management reports are described below.

4.3.1 Monthly Progress Reports

Monthly written progress reports will be submitted by Ruetgers-Nease to the U.S. EPA and the OEPA by the tenth (10th) calendar day of each month following the date of commencement of the field work discussed in Section 6.0 of this Work Plan. The content of these monthly progress reports will include at a minimum:

1. A description of the action which has been taken during the month toward achieving compliance with the Consent Order.

2. All results of sampling and tests and all other raw data produced during the month received by Ruetgers-Nease.

3. All plans and procedures completed during the past month, a description of any variations from the approved RI Work Plan, as well as such data, plans and a description of all actions which are scheduled for the next month.

4. Target and actual completion dates for each activity specified in the SOW schedule and in the Consent Order including the project completion, and an explanation of any deviation from the schedules in the SOW schedule and the Consent Order.

5. Changes in personnel during the month.

6. A description of difficulties encountered in performing work during the reporting period and of actions taken or being taken to rectify problems.

4.3.2 Commencement of Sampling Activities

The U.S. EPA and the OEPA will be notified at least ten (10) business days in advance before any sampling collection activity. Within three (3) business days prior to the sampling activity, a confirmation phone call will be placed regarding the start date of the sampling activity.

4.3.3 Personnel Changes

Should a change in the Project Coordinator be necessary, such a change will be accomplished by notifying the U.S. EPA and the OEPA in writing at least five (5) business days prior to the change. Any other changes in personnel will be reported in the monthly progress reports to the U.S. EPA and the OEPA.

4.3.4 Scope of Work and/or Work Plan Modification

Modifications or changes in the Scope of Work and/or Work Plan volumes may become necessary as the project moves forward. If necessary, these modifications will be approved using procedures set forth in the Plan, Review and Approval, Paragraph XI of the CO. Personnel should notify the Field Operations Manager or Project Manager of the need for modification. These will be brought to the attention of the Principal-in-Charge, and Project Coordinator, who will initiate discussions with the U.S. EPA and the OEPA.

5.0 PROJECT SCHEDULE

RI activities will begin after approval of the RI/FS Work Plan(s).

5.1 Schedule For Implementation of RI/FS Work Plan

The schedule for the implementation of the RI activities is shown on Figure 5-1.

Subject to the provisions of the Consent Order, the project schedule for the RI/FS reports will be as follows:

1. The draft RI report including Endangerment Assessment will be submitted within 360 days from the approval of the RI/FS Work Plan.

2. Within thirty (30) calendar days, or such longer period as the U.S. EPA and the OEPA may establish, of receipt of any U.S. EPA and/or OEPA comments, a revised RI Report including Endangerment Assessment will be submitted.

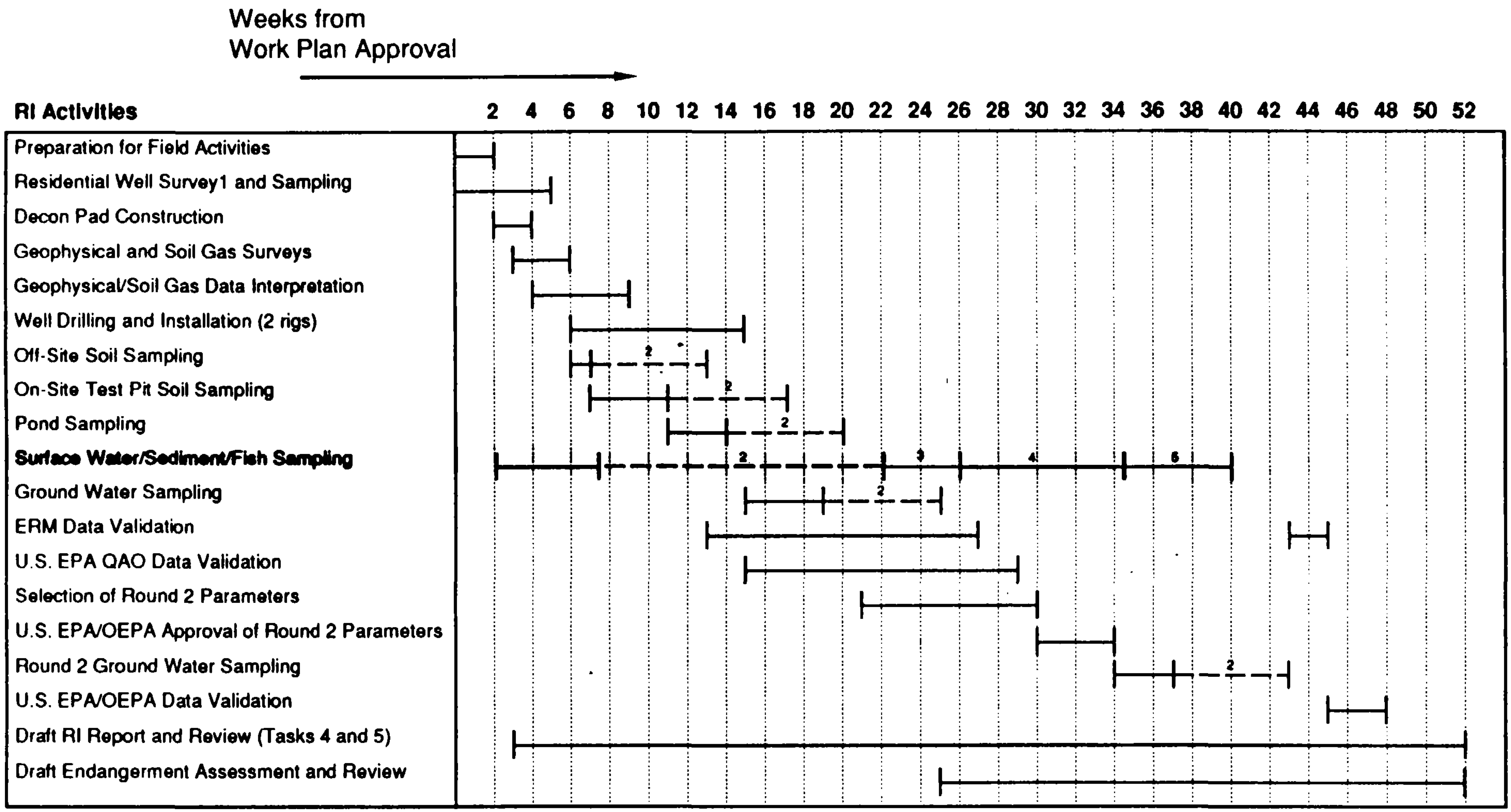
3. The final RI report including Endangerment Assessment will be submitted within 30 days after approval by the U.S. EPA and the OEPA of the draft RI report.

4. The draft FS report will be submitted within 120 days after submission of the final RI report.

5. Within thirty (30) calendar days, or such longer period as U.S. EPA and OEPA may establish, of receipt of any U.S. EPA and/or OEPA comments, a revised FS Report will be submitted.

FIGURE WP 5-1

Schedule for Implementation of RI Activities at the Ruetgers-Nease Salem Site RI/FS



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1. 1/2 mile radius confirmation of 1 mile radius search, residential well sampling
2. Laboratory analysis time
3. ERM data validation for surface water/sediment/fish sample analyses
4. U.S. EPA QAO data validation for surface water/sediment/fish sample analyses
5. Preparation of technical memorandum concerning surface water/sediment/fish sample analytical results

NOTE: Start-up and completion dates may change depending on field conditions

6. The final FS report will be submitted within 30 days from U.S. EPA and OEPA approval of the draft FS.

Any additional work determined to be necessary by Ruetgers-Nease, the U.S. EPA and the OEPA will be addressed pursuant to Paragraph XIII of the Consent Order.

6.0 PRELIMINARY ACTIVITIES

Prior to the performance of the investigation activities described in Section 7.0 of this Work Plan, some preparatory measures will be completed. These preliminary activities are described below.

6.1 Objectives

The objective of the preliminary activities is to enable the RI activities to begin immediately after Work Plan approval.

6.2 Activities

The preliminary activities to be completed prior to RI/FS activities include:

1. Establishing proper access to each drilling location.

2. Preparing the work area (the support and contaminant reduction zones) for the performance of investigative activities.

3. Completing the residential well survey.

4. Closing and sealing Wells P1 and P2 after submission and approval by the agencies of a closure plan.

5. Developing and validating analytical methods and detection limits for mirex, kepone, photomirex, DCNB and DPS.

These activities are discussed below.

6.2.1 Access Agreements

The appropriate access agreements will be obtained prior to the off-site drilling operations.

6.2.2 Preparation of Work Area

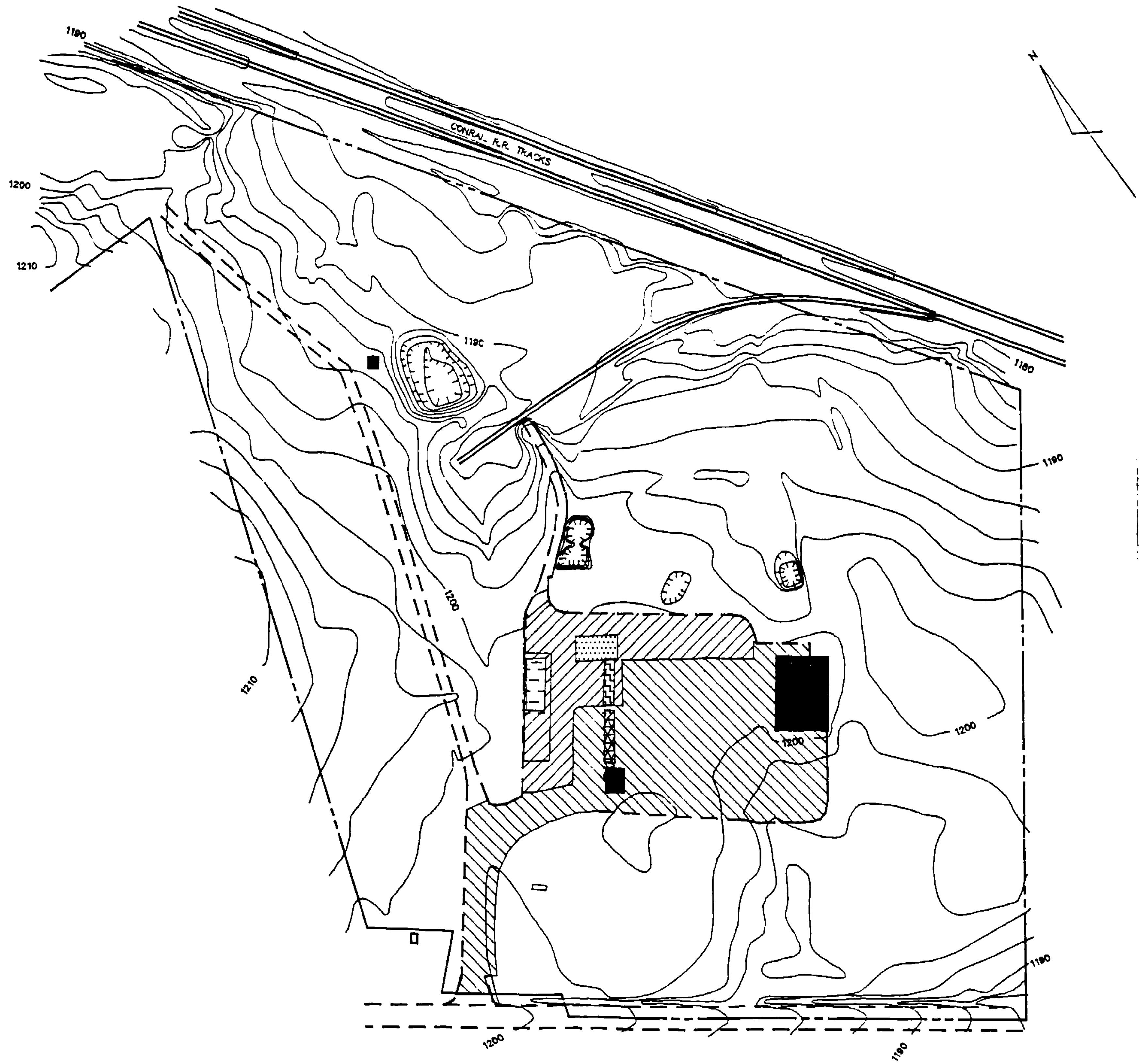
A water supply, electricity, and sanitary services will be established for the work zone. An office and decontamination trailer will be placed within the support and contaminant reduction zones (see Figure 6-1).

6.2.3 Preparation of the Decontamination Area

The site decontamination pad will be built within the contaminant reduction zone (see Figure 6-1). The pad will consist of a concrete slab approximately 15 feet wide and 30 feet long with 4 inch curbs along the perimeter to retain wash water. Wash water generated at the decon pad will be pumped from the pad, collected and stored in an above ground tanks/drums located on site, pending proper disposal.

6.2.4 Residential Well Survey

The residential well survey will be conducted in two phases. The first phase of the residential well survey will involve identifying residences that have a private well within a one-mile radius of the site. This first phase of the survey will use the Ohio Department of Natural Resources and local health department data bases, the local water



LEGEND

SUPPORT ZONE

CONTAMINANT REDUCTION ZONE

DECONTAMINATION

OFFICE TRAILER

DECONTAMINATION TRAILER

PERSONNEL DECONTAIMATION ZONE

EXISTING BUILDING

NOTE: ALL OTHER ON-SITE AREAS ARE WITHIN THE EXCLUSION ZONE.

SCALE

0 60 120 240 (FEET)

CONTOUR INTERVAL = 2 FT

FIGURE WP 6 - 1
EXCLUSION AREAS

RUETGERS-NEASE
SALEM SITE RI/FS

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company customer list and local tax maps. The second phase of the residential well survey will be a direct response confirmation survey. This survey will use primarily postcards and telephone calls, followed by a door-to-door survey where necessary to contact well owners within a one-half mile radius of the site. After Work Plan approval, five residential wells will be chosen for ground-water analysis. In addition, the flowing well at the Salem Country Club will be sampled.

6.2.5 Closure of Wells P1 and P2

The on-site abandoned water supply wells, P1 and P2, may be acting as contaminant transport mechanisms, and will be sealed as part of the preliminary activities.

Methods used to seal P1 and P2 will fully comply with applicable ODNR and OEPA regulations. A Closure Plan has been submitted for U.S. EPA and OEPA approval pursuant to Paragraph XI of the Consent Order. The wells will be characterized as described in the approved Closure Plan.

6.2.6 Method Validation Study

Standard analysis methods do not exist for mirex, kepone, photomirex, DPS and DCNB. Prior to Work Plan approval, Enseco will complete a methods validation study for these five compounds. This study will conform to U.S. EPA protocols. An MVS Plan will be submitted to the U.S. EPA and the OEPA for review, comment and approval pursuant to Paragraph XI of the Consent Order.

7.0 SITE INVESTIGATION (SOW TASK 3)

Upon approval of the work plans developed in Task 2, Ruetgers-Nease will perform those investigations necessary to fully determine the fact, nature, magnitude and extent of any release or threatened release of hazardous substances, pollutants or contaminants from the Site, and its actual or potential hazard to public health and the environment per U.S. EPA RI Guidances. The investigations, at a minimum, will result in data of adequate technical content, quality and quantity to:

1. Determine fully the fact, nature, magnitude and extent of on-site and off-site contamination;

2. Fully identify and characterize migration pathways and routes of entry;

3. Develop an Endangerment Assessment;

4. Support the identification, development, and evaluation of remedial alternatives during the FS, an Endangerment Assessment, remedial technology screening, alternative development and screening, and detailed alternative evaluation.

All Site investigations will follow the work plans developed in Task 2. Any additional work determined to be necessary by Ruetgers-Nease, the U.S. EPA or the OEPA will be addressed pursuant to the additional work provisions (Paragraph XIII) set forth in the Consent Order. Investigation activities which Ruetgers-Nease will conduct are summarized below.

7.1 RI Approach Summary

Ruetgers-Nease, at a minimum, will conduct geophysical surveys; soil borings; drilling, logging, and installation of wells; and soil, surface water, ground water, sediment, fish and air sampling to fully characterize the Site and its actual or potential hazard to public health and the environment, per the U.S. EPA RI Guidelines.

The sequence of RI activities are shown on Figure 5-1. Upon work plan approval, Ruetgers-Nease will begin preparing for on-site activities by constructing a decontamination pad and establishing a field office. Thereafter, geophysical surveys including soil gas analysis, electromagnetic conductivity, and seismic profiling will be conducted to aid in locating contaminants in ground water or in mapping the topography of the bedrock. The proposed locations of these surveys are shown on Figure 7-1.

After a short period of geophysical data evaluation, well installation and sample collection activities will begin. These activities will include, at a minimum:

1. Installation of 21 wells (see Table 7-1) at locations other than D, E, J, and K. An estimated 15 wells will be installed at locations D, E, J, and K independent of and without consideration of geophysical surveys data.

   Wells will be installed at locations shown on Figure 7-2.

2. Sampling of 30 existing and all new monitoring wells, the Salem Country Club well, plus five off-

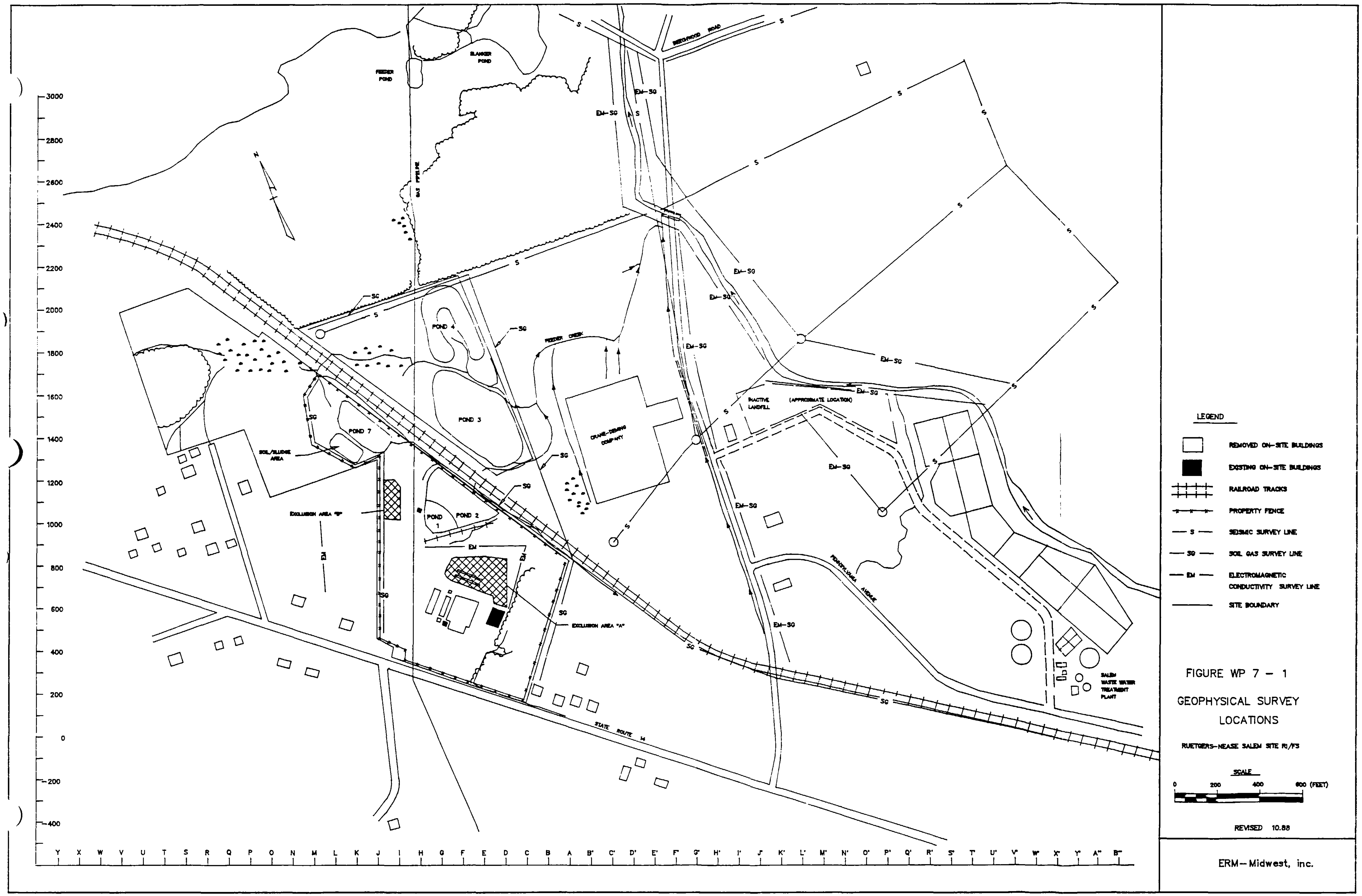

FIGURE WP 7 - 1

GEOPHYSICAL SURVEY LOCATIONS

RUETGERS-NEASE SALEM SITE RI/FS

WP TABLE 7-1

MONITORING WELLS AND TARGET AQUIFERS BY DRILLING AREA
RUETGERS-NEASE SALEM SITE RI/FS

Proposed Drilling Area	Shallow Aquifer	Interface Aquifer	Upper Bedrock Aquifer	Lower Bedrock Aquifer	Note
A	1		1		
B	1				
C	1	1	1	1	1
D					2
E					3
F		1	1		1,4
G			1		
H	1	1	1		1
I	1	1	1	1	5
J					2
K					2
L	1	1	1	1	1
TOTAL	6	5	7	3	

NOTES:

1. If the Interface Aquifer is not encountered, the well will be completed in an overlying water bearing zone if one is encountered.
2. Well cluster, assume 4 water bearing zones.
3. Well cluster, assume 3 water bearing zones.
4. The Upper Bedrock well can only be installed if the Upper Bedrock Aquifer is encountered at this location.
5. Potential Background wells.

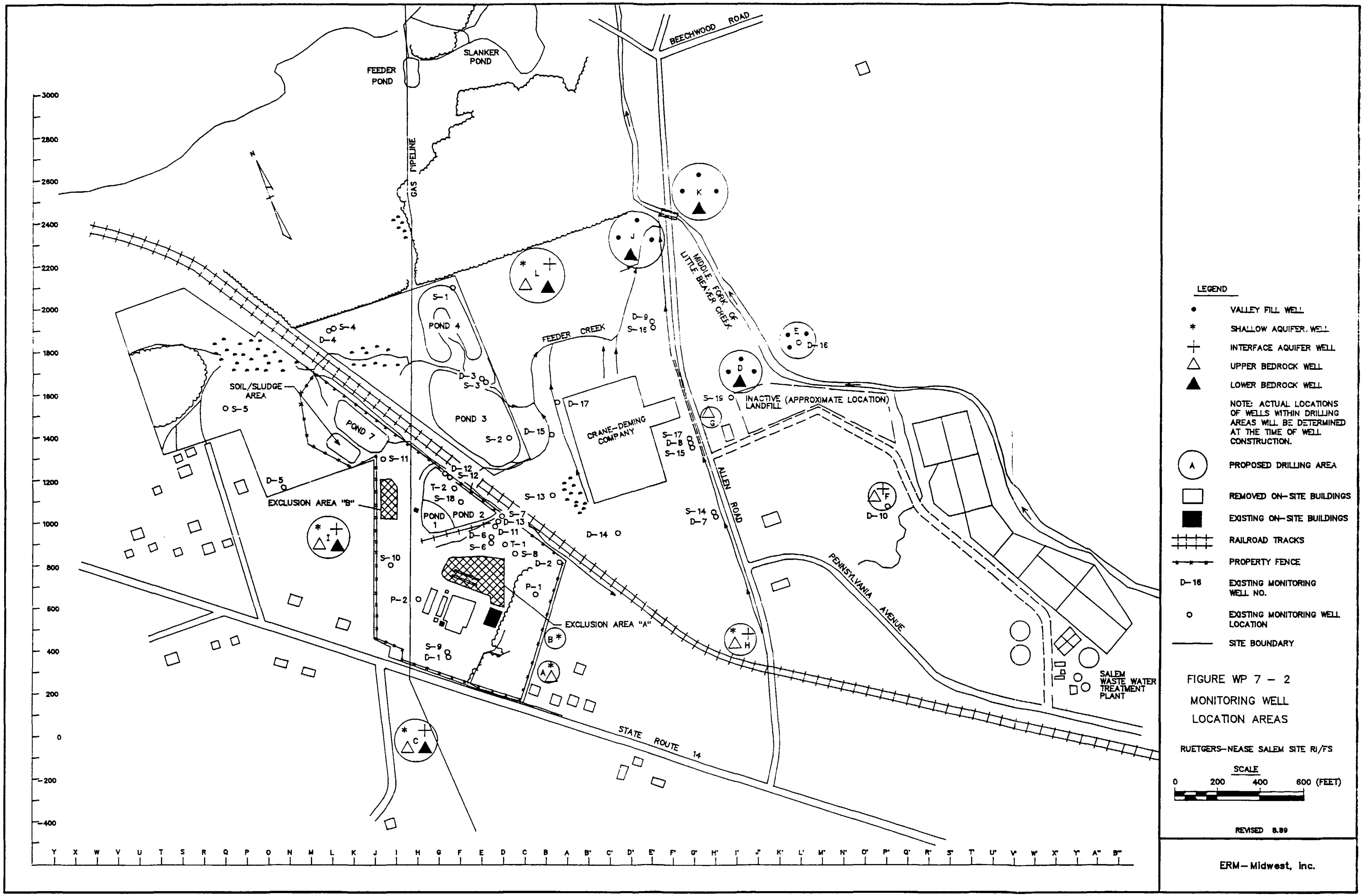

FIGURE WP 7 - 2
MONITORING WELL LOCATION AREAS

site private wells, for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex, and diphenyl sulfone (DPS). Four of the most contaminated wells on-site will be sampled additionally for 3,4-dichloronitrobenzene (3,4-DCNB), dioxins/furans and CLP inorganics. Existing wells scheduled for sampling are identified on Table 7-2.

3. Sampling soil in 30 on-site test pits located about on-site locations such as: in suspected areas of waste management activities, where previous samples indicated high concentrations of mirex or other compounds, in areas down-slope from waste management areas, and as necessary along the railroad tracks. The pits will be dug using a backhoe and sampled in the exposed, undisturbed stratum of the pits. Samples will be collected from land surface to 0.5 feet below land surface (BLS), from 0.5 to 3.5 feet BLS, and from 3.5 to 6.5 feet BLS, plus additional three foot cores until HNU and OVA measurements are less than 10 ppm in the top six inches of remaining subsurface soils. Samples will be collected below the 9.5 feet BLS level only if the water table has not been encountered. All samples will be analyzed for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex, and DPS. Samples from one test pit in each of Exclusion Areas A and B, and from four of the remaining potentially most contaminated on-site areas will be analyzed additionally for 3,4-DCNB, dioxins/furans and CLP inorganics. The locations of the test pits are shown on Figure 7-3.

WP TABLE 7-2

EXISTING GROUND WATER SAMPLE LOCATIONS[1]
RUETGERS-NEASE SALEM SITE RI/FS

Shallow Wells	Interface Wells	Upper Bedrock Wells	Lower Bedrock Wells	Residential Wells
S1	S2	T2[2]	D10	5 wells in addition to the Salem Country Club
S4	S13	D1	D13	
S6[2]	S16	D2	D14	
S8	S17	D3	D16	
S9	S18[2]	D5		
S11	S19	D7		
S12[2]		D8		
S14		D9		
S15		D11		
		D12		
		D15		

[1]Proposed sample locations for all new monitoring wells are shown on Figure 3-2.

[2]Wells to be sampled/analyzed for the additional parameters DCNB, dioxins/furans and CLP inorganics

LEGEND

REMOVED ON-SITE BUILDINGS

EXISTING ON-SITE BUILDINGS

RAILROAD TRACKS

PROPERTY FENCE

SOIL BORING-CHEMICAL

SOIL BORING-PHYSICAL

SOIL TEST PIT-CHEMICAL

SITE BOUNDARY

TEST PIT FOR EXPANDED ANALYSIS

FIGURE WP 7 – 3

SOIL SAMPLING LOCATIONS ON-SITE AND ADJACENT AREAS

RUTGERS-NEASE SALEM SITE RI/FS

SCALE

0 200 400 600 (FEET)

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4. Collecting samples from soil borings for chemical analysis at fourteen locations through the five waste ponds and the soil/sludge area west of Pond 7, with samples collected at three foot intervals. Borings will extend to bedrock or to nine feet into native soils whichever is less. Screening will be performed on each three-foot interval using an OVA to select the sub-interval with the highest response. This sub-interval will be taken as a grab sample and will be analyzed for CLP volatile organics and library searches for up to 15 compounds. If there are no observed differences in OVA responses between sub-intervals, the middle of the interval will be sampled as a grab and will be analyzed for CLP volatile organics and library searches for up to 15 compounds.

   A composite of the entire 3-foot interval of soils/sludges (non-native soils) will then be homogenized and analyzed for CLP non-volatile* organics plus a library search for up to 25 additional compound plus mirex, kepone, photomirex, and DPS.

   Samples of native soils below the pond bottoms will be analyzed for CLP volatile organics and library searches for up to 15 compounds, plus mirex, kepone, photomirex, methoxychlor and DPS.

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*Non-volatile organics are defined as the TCL semi-volatile organic compound list and the TCL pesticide/PCB organic compound list.

Composites of samples from all borings collected from the same depths in native soils below individual ponds (e.g., a composite will be made from samples collected from the first three feet of native soils below the pond bottom from the three chemical boreholes in Pond 2) will be analyzed for CLP non-volatile organics (i.e., pesticide, base/neutral, and acid extractable fractions) plus a library search for 25 additional compounds. Samples of non-native soils/sludges from a series of three foot cores from one borehole in each pond and in the soil/sludge area west of Pond 7 will be analyzed additionally for 3,4-DCNB, dioxins/furans and CLP inorganics. Borehole locations are shown on Figure 7-3.

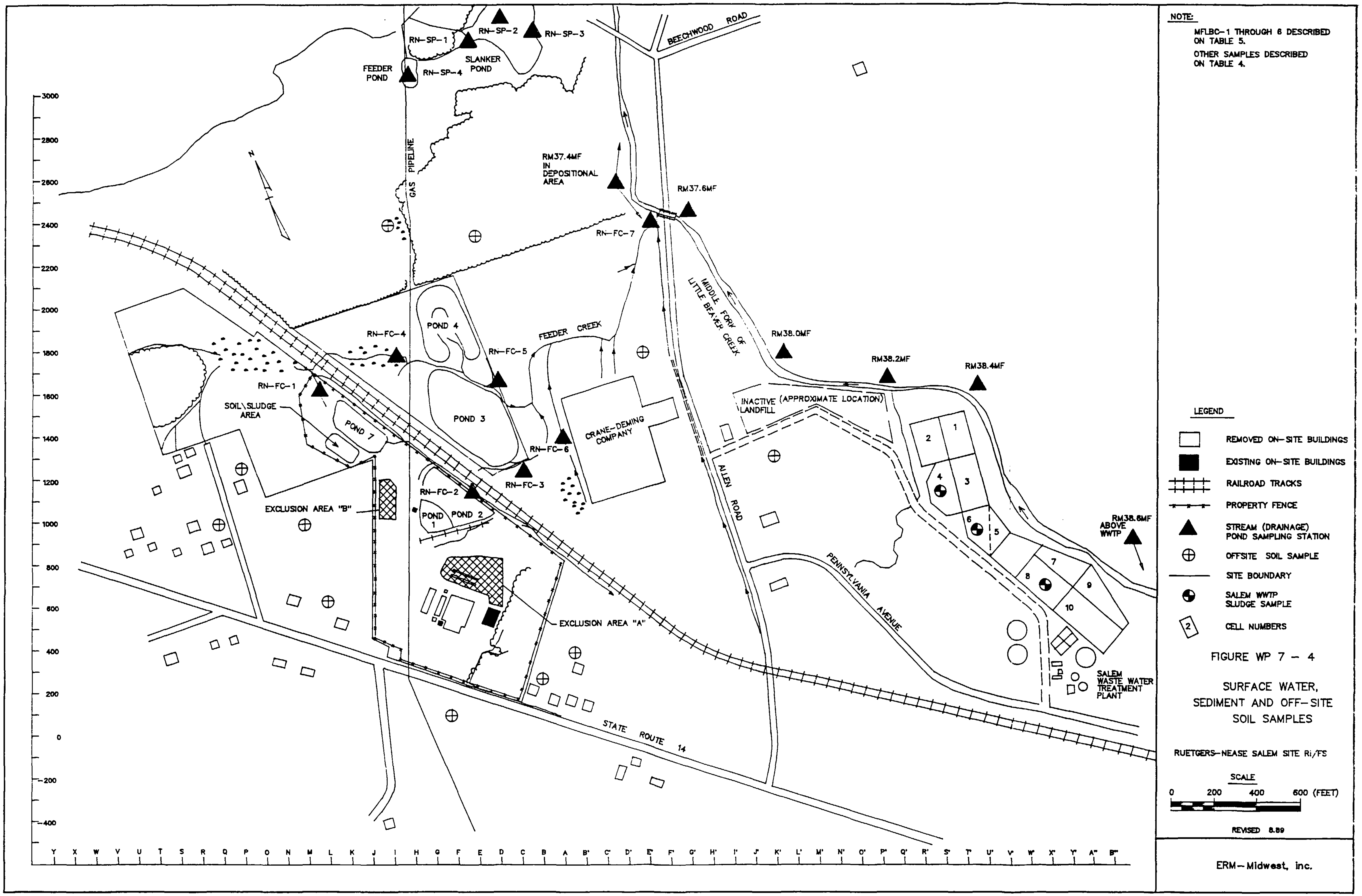
5. Collecting a series of three foot core samples from soil borings for physical analysis at one location through each pond. Borings will extend to bedrock, and samples will be analyzed for those physical parameters such as: soil classification, specific gravity, permeability, effective porosity, hydraulic conductivity, particle size analysis, moisture content, and Atterberg Limits, which are necessary to conduct the EA, using the Superfund Exposure Assessment Guidance Manual (SEAM) and the Superfund Public Health Evaluation Manual (SPHEM), and the FS. Borehole locations are shown on Figure 7-3.

6. Collecting sediment samples at three locations and one sediment and one surface water sample at one location in Slanker Pond (one fish sample also will be collected from Slanker Pond); sediment samples at three locations on-site; sediment and

surface water samples at three additional locations in Feeder Creek draining the Site; and one location in the drainage ditch parallel to the west wall of the Crane-Deming Building. These samples will be analyzed for CLP organics plus a library search collectively for 40 additional compounds, plus mirex, photomirex, kepone, and DPS. 3,4-DCNB, dioxins/furans, and CLP inorganics may be analyzed for if they are detected above background levels in on-site samples. Sediment and surface water sampling locations are shown on Figure 7-4 and are described on Table 7-3.

7. Collecting fish, sediment, and surface water samples at 18 locations; sediment and surface water samples at three additional locations; fish at one additional location; fish and surface water at one additional location, fish and sediment samples at eight additional locations; sediment samples at 22 locations in the MFLBC and/or the flood plain. These locations are shown on Figure 7-5 with sample type by location and parameters identified on Table 7-3. These samples will be collectively analyzed for CLP organics plus a library search for 40 compounds, plus mirex, photomirex, kepone, and DPS. 3,4-DCNB, dioxins/furans and CLP inorganics may be analyzed for if they are detected above background levels in on-site matrices.

8. Collecting soil samples at eleven locations off-site. Samples will be collected from land surface to 0.5 feet BLS, from 0.5 feet to 3.5 feet BLS,


NOTE:
MFLBC-1 THROUGH 6 DESCRIBED ON TABLE 5.
OTHER SAMPLES DESCRIBED ON TABLE 4.
LEGEND
REMOVED ON-SITE BUILDINGS
EXISTING ON-SITE BUILDINGS
RAILROAD TRACKS
PROPERTY FENCE
STREAM (DRAINAGE) POND SAMPLING STATION
OFFSITE SOIL SAMPLE
SITE BOUNDARY
SALEM WWTP SLUDGE SAMPLE
CELL NUMBERS
FIGURE WP 7 - 4
SURFACE WATER, SEDIMENT AND OFF-SITE SOIL SAMPLES
RUETGERS-NEASE SALEM SITE Ri/FS
SCALE
0 200 400 600 (FEET)
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RN-SP-1
RN-SP-2
RN-SP-3
RN-SP-4
SLANKER POND
FEEDER POND
BEECHWOOD ROAD
GAS PIPELINE
RM37.4MF IN DEPOSITIONAL AREA
RM37.6MF
RN-FC-7
MIDDLE FORK OF LITTLE BEAVER CREEK
RM38.0MF
RM38.2MF
RM38.4MF
RM38.6MF ABOVE WWTP
FEEDER CREEK
POND 4
RN-FC-4
RN-FC-5
RN-FC-1
SOIL\SLUDGE AREA
POND 7
POND 3
CRANE-DEMING COMPANY
RN-FC-6
RN-FC-3
RN-FC-2
POND 1
POND 2
EXCLUSION AREA "B"
EXCLUSION AREA "A"
INACTIVE LANDFILL (APPROXIMATE LOCATION)
ALLEN ROAD
PENNSYLVANIA AVENUE
STATE ROUTE 14
SALEM WASTE WATER TREATMENT PLANT
1 2 3 4 5 6 7 8 9 10
3000 2800 2600 2400 2200 2000 1800 1600 1400 1200 1000 800 600 400 200 0 -200 -400
Y X W V U T S R Q P O N M L K J I H G F E D C B A B' C' D' E' F' G' H' I' J' K' L' M' N' O' P' Q' R' S' T' U' V' W' X' Y' A" B"
N

WP TABLE 7-3
Sampling Program for Survey of Feeder Creek, Slanker Pond, and Middle Fork of Little Beaver Creek

Description	Station	5/16/89 Agreed Location No.	Analysis: Media F	SW	S	FP	Parameters: CLP +40	CLP Non-Vol +25	M, P, K, DPS	M, P, K, DPS, ME
Upstream of the WWTP as stream crosses Rte. 45	RM 38.6 MF	#1	2	1	1		4		4	0
NE corner WWTP	RM 38.4 MF	#2		1	1		2		2	0
Golf course stream	RM 38.2 MF	#3		1	1		2		2	0
Discharge zone	RM 38.0 MF	#4		1	1		2		2	0
Upstream Allen Road	RM 37.6 MF	#5	2	1	1		4		4	0
Feeder/Slanker Pond	RN -SP- 4	#6A			1				1	0
Slanker Pond, inlet	RN - SP - 1	#6B			1				1	0
Slanker Pond, middle	RN - SP - 2	#6C	2	1	1		4		4	0
N. of Slanker Pond beach	RN - SP - 3	#6D			1				1	0
Allen Road downstream (Slanker Bridge, north)	RM 37.4 MF	#7	2	1	1		4		4	0
Pine Lake Road bridge	RM 36.7 MF	#8	2	1			3		3	0
Between Goshen Road and Rte. 165	RM 35.4 MF	#9	2					2	2	0
Miller Farm	RM 35.0 MF	#10			1	4		0	0	5
Swamp area 0.3 RM south of Middletown Road		#11			1			0	1	0
Ruthraff Farm	RM 33.3 MF	#12			1	4		0	0	5
Rte. 45 (0.7 mi. N of Middletown Road)	RM 32.0 MF	#13	2	1	1			4	4	0
Swamp area between Rte. 45 and Rte. 62		#14			1			0	1	0
Rte. 62		#15	2		1			3	3	0
Swamp area 0.45 RM south of Rte. 62		#16			1			0	1	0
Sherwood Farm		#17			1	4		0	0	5
Rte. 165		#18	2	1	1			4	4	0
Beaver dam 1.85 RM south of Rte. 165		#19			1			0	1	0
Large swamp are west of beaver dam		#19A			1	4		0	0	5
Large swamp are east of beaver dam (Shepherd dam)		#19B			1	4		0	0	5
Pine Lake Road bridge		#20	2	1	1			4	4	0
0.7 RM south of Pine Lake Road bridge		#21			1			0	1	0
Due east of intersection of E. 10th St. & Egypt Rd.		#22	2		1			3	3	0
Private bridge 0.45 RM south of Rte. 14 bridge		#23	2	1	1			4	4	0
N. Lisbon Rd-Rte. 14 at river bend	RM 24.5 MF	#24			1			0	1	0
Swamp area due west of EPA '89 station 24		#25			1			0	1	0
Swamp area 0.53 RM south of EPA '89 station 24		#26			1			0	1	0
Camp Farm		#27			1	4		0	0	5

KEY:
F = Fish
SW = Surface Water
S = Sediment
B = Benthos
FP = Floodplain Sediment
M = Mirex
P = Photomirex
K = Kepone
DPS = Diphenyl sulfone
ME = Methoxychlor

ASSUMPTIONS:
- 2 fish samples per station
- 4 floodplain samples per location

NOTES:
-No Station #36
-The analysis of CLP+40 and CLP non-volatile+25 includes the analysis of methoxychlor

WP TABLE 7-3

Sampling Program for Survey of Feeder Creek, Slanker Pond, and Middle Fork of Little Beaver Creek

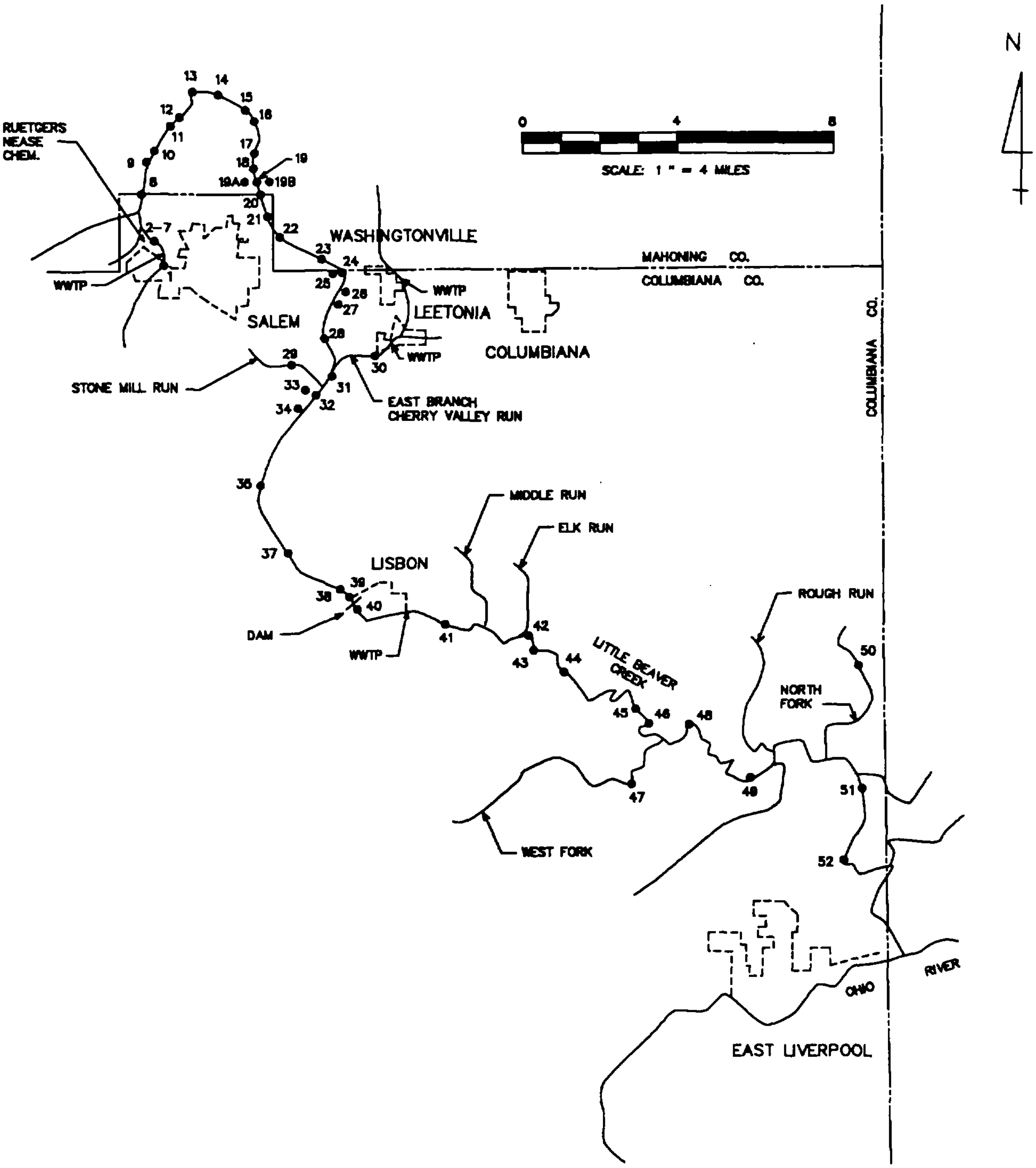
			Analysis							
		5/16/89	Media				Parameters			
		Agreed					CLP	CLP Non-	M, P, K,	M, P, K,
Description	Station	Location No.	F	SW	S	FP	+40	Vol +25	DPS	DPS, ME
Railroad bridge over Lisbon-Canfield Road	RM 23.5 MF	#28	2	1	1			4	4	0
Cunningham Road bridge over Stone Mill Run	RM 2.0 SMR	#29	2	1	1			4	4	0
Erie-Lackawanna bridge over E. Branch Cherry Valley Run		#30	2	1	1			4	4	0
SE bank of confluence of MFLBC & Cherry Valley Cr.		#31			1			0	1	0
0.23 RM south of old Rte. 344 bridge		#32			1			0	1	0
Swamp area due west of EPA '89 station 32		#33			1			0	1	0
Swamp area 0.68 RM north of Rte. 45		#34			1			0	1	0
Teagarden bridge on Eagleton Road	RM 17.5 MF	#35	2	1	1			4	4	0
Coleman Road bridge	RM 15.1 MF	#37	2		1			3	3	0
0.37 RM south of Furnace Road bridge		#38			1			0	1	0
Above Lisbon dam	RM 12.5 MF	#39	2		1			3	3	0
Below Lisbon spillway	RM 12.5 MF	#40	2	1	1			4	4	0
0.6 RM west of EPA '89 station 42		#41			1			0	1	0
Elkton West Point Road bridge		#42	2	1	1			4	4	0
0.2 RM east of EPA '89 station 42		#43			1	4		0	0	5
Beaver Creek State Park canoe livery 2.25 mi. east of Elkton	RM 4.6 MF	#44	2		1			3	3	0
Beaver Hollow Road Bridge		#45	2		1			3	3	0
Swamp area by Rte. 7 north of Williamsport		#46			1			0	1	0
Y Camp Road bridge	RM 14.4 WB	#47	2	1	1			4	4	0
Bell School Road bridge	RM 14.4 LBC	#48	2	1	1			4	4	0
Sprucevale Bridge-Beaver Creek State Park	RM 11.0 LBC	#49	2		1			3	3	0
Fredricktown bridge	RM 0.2 LBC	#50	2	1	1			4	4	0
1 RM south of MFLBC/NFLBC confluence		#51	2		1			3	3	0
Grimms Road bridge gauging station	RM 4.5 LBC	#52	2	1	1			4	4	0
Feeder Creek NNW of Pond 7	RN-FC-1	#53			1		1		1	
Feeder Creek East of Pond 2	RN-FC-2	#54			1		1		1	
Feeder Creek S of Pond 3	RN-FC-3	#55		1	1		2		2	
Feeder Creek (Swamp) W of Pond 4	RN-FC-4	#56			1		1		1	
Feeder Creek S of Pond 4	RN-FC-5	#57		1	1		2		2	
Feeder Creek W of Crane-Deming	RN-FC-6	#58		1	1		2		2	
Feeder Creek Prior to entering MFLBC	RN-FC-7	#59		1	1		2		2	
Subtotal			56	26	61	28	36	82	136	35
Total			171				289			

KEY:
F = Fish
SW = Surface Water
S = Sediment
B = Benthos
FP = Floodplain Sediment
M = Mirex
P = Photomirex
K = Kepone
DPS = Diphenyl sulfone
ME = Methoxychlor

ASSUMPTIONS:
- 2 fish samples per station
- 4 floodplain samples per location

NOTES:
-No Station #36
-The analysis of CLP+40 and CLP non-volatile+25 includes the analysis of methoxychlor

FIGURE WP 7 – 5
SCHEMATIC MAP OF THE MIDDLE FORK LITTLE BEAVER CREEK
SHOWING GENERAL AREAS OF RI SAMPLING LOCATIONS
(REFER TO TABLE 7-3 FOR SPECIFIC LOCATION DESCRIPTIONS)
RUETGERS – NEASE SALEM SITE RI/FS



NOTE: NO STATION # 36

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plus additional three foot cores until HNU and OVA measurements are less than 10 ppm in the top six inches of remaining subsurface soils. Samples will be collected below 9.5 feet BLS only if the water table has not been encountered. These samples will be analyzed for CLP non-volatile organics plus a library search for 25 compounds, plus mirex, photomirex, kepone, DPS. 3,4-DCNB, dioxins/furans and CLP inorganics may be analyzed for if they are detected above background levels in on-site samples. These locations are shown on Figure 7-4.

9. Slug testing of monitoring wells and collecting water level elevations from all monitoring wells to identify ground water flow patterns. A full pump test will be conducted if the slug test results are inconclusive, pursuant to the additional work provisions of Paragraph XIII of the Consent Order.

10. Collect one composite sludge sample at three locations at the Salem Wastewater Treatment Plant. The sample locations will be at sludge cells 4, 6, and 8, which were reportedly in use during the time that the Nease facility discharged wastewater to the treatment plant. The three composite sludge samples will be analyzed for CLP organics and inorganics, mirex, photomirex, kepone, and DPS.

Samples collected during the field efforts will be analyzed according to approved procedures as specified in the work plans at a laboratory satisfactory to the U.S. EPA/OEPA. After data is validated by the Project QA/QC Manager and subsequently approved by the U.S. EPA/OEPA, data will be evaluated to identify:

1. Selected parameters for Round 2 of ground water sampling. These will be submitted to the U.S. EPA and the OEPA for approval.

2. The need, locations, and parameters for additional samples of other media to be collected pursuant to the additional work provisions of Paragraph XIII of the Consent Order. These will be submitted to the U.S. EPA and the OEPA for approval.

Task 3 activities that Ruetgers-Nease will conduct are described in detail in the following sections.

7.2 <u>Waste Characterization</u>

Studies have been conducted by Ruetgers-Nease since 1982 at the Site and in the surrounding areas to characterize the wastes present.

Two major groups of contaminants were found by Ruetgers-Nease at the Site:

1. Volatile Organic Compounds; and

2. Mirex and other non-volatile compounds.

Specific volatile and non-volatile compounds were selected for analysis by Ruetgers-Nease as indicator compounds. These indicator compounds are listed in Table 7-4. The non-volatile compounds selected as key indicator chemicals were chosen because they are relatively stable and

TABLE 7-4

COMPOUNDS INCLUDED IN TYPICAL SAMPLE ANALYSES CONDUCTED IN THE PAST BY RUETGERS-NEASE PRIOR TO THE RUETGERS-NEASE SALEM SITE RI/FS

(1) Total Volatile Organics

Benzene
Chlorobenzene
Chloroform
o,m,p-Dichlorobenzene
1,1-Dichloroethene*
1,2-Dichloroethane
1,2-Dichloroethene*
1,2-Dichloropropane*
1,3-Dichloropropene*
Ethylbenzene*
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
1,1,1-Trichloroethane*
Trichloroethene
o,m,p-Xylenes

* The presence of these chemical compounds is accounted for as minor contaminants ordinarily present in technical grade materials purchased for commercial use.

Table 7-4 (continued)

COMPOUNDS INCLUDED IN TYPICAL SAMPLE ANALYSES
CONDUCTED IN THE PAST BY RUETGERS-NEASE PRIOR
TO THE RUETGERS-NEASE SALEM SITE RI/FS

The following compounds were chosen as key indicator chemicals to determine and track the relative degree of residual contamination of soil and ground water. The compounds are quite stable, reasonably distinct, will give good response on gas chromatographic analysis with a minimum of interference from other compounds, and were believed to be characteristic of the Site.

(2) 3,4-Dichloronitrobenzene

(3) Diphenyl Sulfone (DPS)

(4) Methoxychlor

(5) Mirex

readily analyzed, and because they were believed to be characteristic of the Site.

In April 1984, selected samples of composite soils and sludges as well as water from various areas on the site were analyzed for priority pollutants (volatiles, acid extractables, base/neutrals, pesticides/PCBs) and dioxin, some analyses of which were performed at high detection levels. These data have not been validated by the Agencies.

Highest concentrations of indicator chemicals were found in Exclusion Areas A and B as well as in Ponds 1 and 2. Low to nondetected concentrations of indicator chemicals were found on the remainder of the Site and in Ponds 3, 4 and 7. On the basis of these data Ruetgers-Nease removed soils from Exclusion Areas A and B. Additional samples were taken and additional soils were removed. At this time, materials in Pond 1 as well as the surrounding soil were also removed until there was no physical evidence of contamination. Collection of soil samples from the bottom and side of Pond 1 later indicated that soil with indicator chemicals still remained.

The waste characterization sampling and analysis program will fully determine the fact, nature, extent, and magnitude of contaminants found in on and off-site surface and subsurface soils, sludges, and fill material. Specific objectives of the waste characterization sampling program, at a minimum, will include determining:

1. The fact, nature, extent and magnitude of surface and subsurface soil contamination;

2. The geometry and thickness of the sludge/fill material in the ponds, soils, wetland areas, and

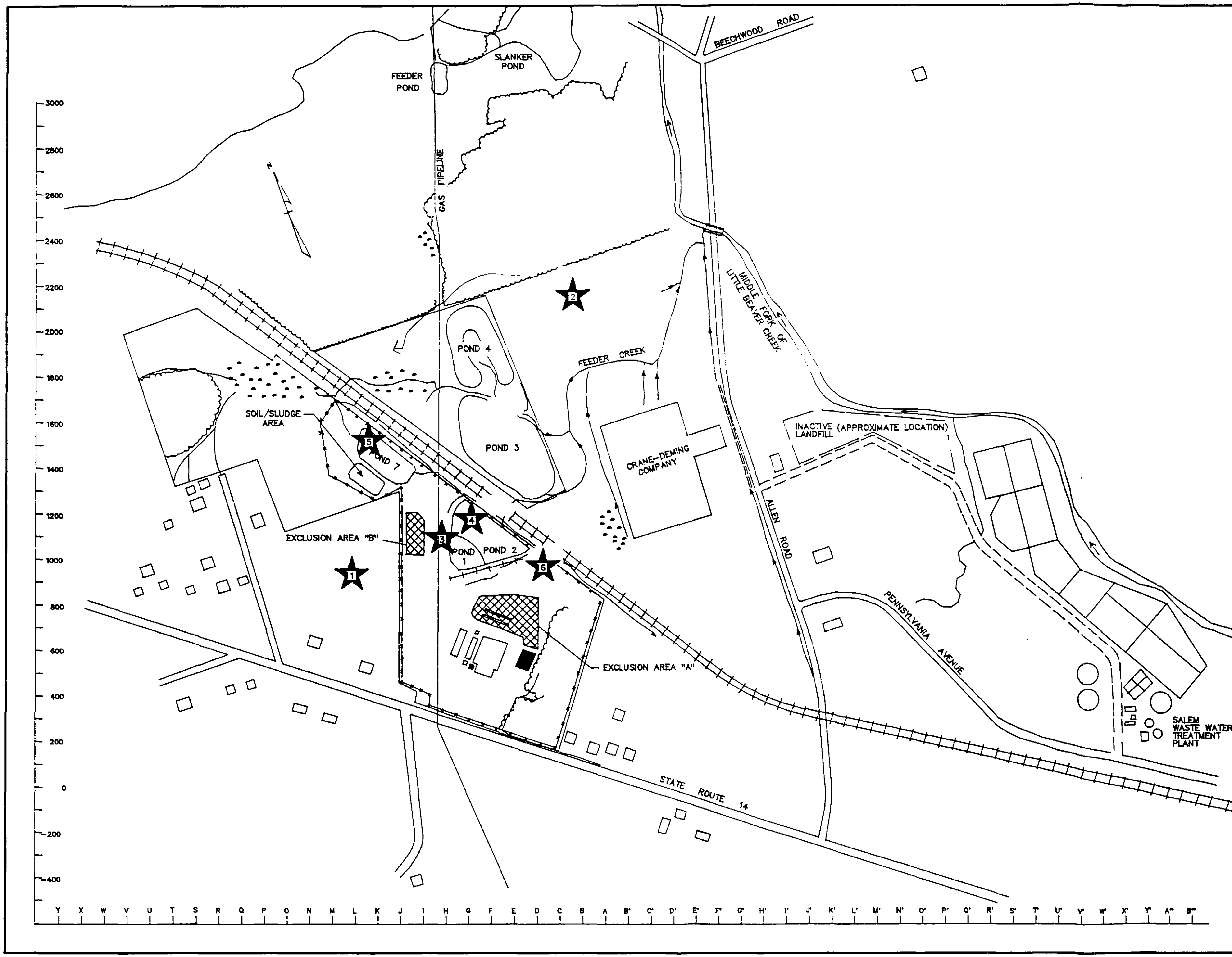

FIGURE WP 7 - 7
ANTICIPATED AIR MONITORING STATIONS

RUETGERS-NEASE SALEM SITE RI/FS

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dependent as is the case with volatiles. At least one off-site sampling location will be chosen for background. At least one of the on-site sampling locations will be near the downwind boundary line. Sampling will occur over a 24-hour period (noon to noon) and every effort will be made for sampling during dry, warm, and moderately calm periods of weather.

7.6.5.4 Sample Analysis

Chemical analyses will be performed according to US EPA protocols for the CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex, and diphenyl sulfone. Analyses will be performed by Enseco. The hi-volume filter will be dessicated and weighed to ascertain particulate weight gain for the initial weighing. Sample volumes will be utilized to calculate ambient particulate levels. Dioxins/furans, 3,4-DCNB and CLP inorganics may be analyzed for, if they are detected above background levels in on-site samples.

8.0 SITE INVESTIGATION ANALYSIS (SOW TASK 4)

A thorough analysis and summary of the results of all quality assured data will be included in the Site investigation analysis. The objective of this task will be to ascertain if the investigation data are sufficient in quality and quantity to support an EA of the Site, an ATSDR health assessment, and a FS. The results from all quality assured data will be organized and presented logically so that the relationships between each medium are apparent.

All investigation data will be analyzed to develop a summary of the fact, nature, extent and magnitude of any release or threatened/release of hazardous substances, pollutants or contaminants at the Site. The summary will, at a minimum, consist of:

1. The determination of the site and local hydrogeologic setting;

2. The identification of contaminant sources, pathways and receptors;

3. The fact, nature, extent and magnitude of contamination related to the Site in the various media;

4. The quantities and concentrations of specific chemicals at and about the Site and ambient levels in all media surrounding the Site;

5. The number, locations, and types of nearby population and activities and pathways that may result in an actual or potential threat to public health, welfare, or the environment.

The results and the data of the Site investigation analysis and summary will be presented in the Remedial Investigation Report.

9.0 REMEDIAL INVESTIGATION REPORTS (SOW TASK 5)

A draft of the Remedial Investigation Report including the EA will be prepared and submitted within 360 days of Work Plan approval to the OEPA and the U.S. EPA for approval. The Report shall include the results of Tasks 1 through 4 with all information generated during the RI and the EA included in appendices. Revised reports will be submitted to the U.S. EPA and the OEPA within 30 days of receipt of written comments and notice of report disapproval, unless U.S. EPA and OEPA specify, in writing, a longer period for revision. The final RI Report will be submitted within 30 days after written notice of approval of the draft RI Report in accordance with the Consent Order.

10.0 REMEDIAL ALTERNATIVES SCREENING (SOW TASK 6)

Data collected during the RI will be used to evaluate feasible remedial alternatives in keeping with the U.S. EPA feasibility study guidance document and the NPL. These activities are described below.

10.1 Preliminary Remedial Technologies

A master list of potentially feasible technologies will be developed. These technologies will include both on-site and off-site remedies, depending on Site problems. The master list will be screened based on Site conditions, waste characteristics, and technical requirements, to eliminate or modify those technologies that: 1) may prove extremely difficult to implement, 2) will require unreasonable time periods, or 3) will rely on insufficiently developed technology. Emerging technologies will be evaluated. A separate memorandum will be prepared documenting the product of this task.

10.2 Development of Alternatives

Based on the results of the remedial investigation and consideration of preliminary remedial technologies, a limited number of alternatives will be developed which are based on objectives established for the response.

1. Establishment of Remedial Response Objectives

Site-specific objectives will be established for the response. These objectives will be based on public health and environmental concerns, the description of the current situation, information gathered during the remedial investigation, Section 300.68 of the National Contingency Plan (NCP), the U.S. EPA's interim guidance, and the requirements of any other applicable U.S. EPA, Federal, and State of Ohio environmental standards, guidelines and advisories as defined under Section 121, CERCLA, as amended. Preliminary cleanup objectives will be developed in formal consultation with the U.S. EPA and the OEPA.

2. Alternative Remedial Actions

Combinations of identified technologies will be assembled into alternative remedial actions. To the extent that it is both feasible and appropriate, alternatives and other appropriate considerations will be developed into a comprehensive site specific approach. Alternatives are to be developed to include the following:

a. Treatment alternatives for source control that would eliminate the need for long-term management (including monitoring).

b. Alternatives involving treatment as a principal element to reduce the toxicity, mobility, or volume of the Site waste.

3. Additional Alternatives

A minimum of two additional alternatives will be developed as follows:

a. An alternative that involves containment of waste with little or no treatment, but provides protection of human health and the environment primarily by preventing potential exposure or reducing the mobility of the waste.

b. A no action alternative.

For ground water response actions, a limited number of remedial alternatives will be developed within a performance range that is defined in terms of a remediation level within the risk range of 10^{-4} to 10^{-7} for maximum lifetime cancer risk and includes different rates of restoration. Where feasible, one alternative will be configured that would restore ground water to a 10^{-6} for maximum lifetime cancer risk level within five years.

Many remedial action alternatives involve both source control and ground water response actions. The dynamic relationship between these two elements requires that they be formulated together so that the comprehensive remedial action is effective and the elements are complementary. The different requirements of each, however, dictate that they be detailed separately in the development and analysis of the alternatives.

10.3 Initial Screening of Alternatives

1. Initial Screening

The alternatives developed under SOW Task 6B will be subjected to an initial screening to narrow the list of potential remedial actions for the detailed analysis. The rationale for eliminating an alternative will be included. Considerations to be used in the Initial Screening include:

Effectiveness. Alternatives will be evaluated as to whether or not they adequately protect human health and the environment; attain Federal and State of Ohio ARARs or other criteria, advisories, or guidance; significantly and permanently reduce the toxicity, mobility, or volume of hazardous constituents; and are technically reliable, or are effective in other respects. Reliability includes the potential for failure and the need for replacement of the remedy.

Implementability. Alternatives will be evaluated as to the technical feasibility and availability of the technologies each alternative would employ; the technical and institutional ability to monitor, maintain, and replace technologies over time; and the administrative feasibility of implementing the alternative.

Cost. The costs of construction and any long-term costs to operate and maintain the alternatives will be evaluated. A detailed cost analysis will not be necessary at this time. During the initial screening, cost will be an important factor when comparing alternatives providing similar results, but not between treatment and nontreatment alternatives.

2. Preservation of Alternatives

The initial screening of alternatives incorporating treatment will be conducted with the intent of:

a. Preserving the most promising alternatives as determined by their likely effectiveness and implementability.

b. Preserving for further analysis a range of alternatives as described in Task 6B.

Innovative alternative technologies will be carried through the screening process if there is a reasonable belief that they offer either potential for better treatment, performance or implementability; fewer or lesser adverse impacts than other available approaches; or lower costs for similar levels of performance than demonstrated treatment technologies.

The containment and no action alternatives will be carried through the initial screening to the detailed analysis.

10.4 Alternatives Array Document

For the purpose of obtaining ARARs from the State of Ohio, a detailed description of alternatives will be prepared which will include extent of remediation, contaminant levels to be addressed, and method of treatment. A brief history and Site background, a Site characterization indicating contaminants, pathways, receptors, and other pertinent Site features will be included. A copy of the Alternatives Array Document will be provided to the OEPA with a request for notification of State of Ohio standards, after a copy to the U.S. EPA and the OEPA has been received and approved.

10.5 RI - Phase 2 Post-Screening Field Investigation

Alternatives undergoing the detailed analysis may require, as appropriate, additional field investigations to obtain the necessary data for further evaluation of site characteristics and alternatives. Laboratory and bench scale studies may be required as part of this subtask.

11.0 REMEDIAL ALTERNATIVES EVALUATION (SOW TASK 7)

Alternatives passing through the screening process will undergo a detailed evaluation using the procedures described below.

11.1 Detailed Analysis of Alternatives

1. Evaluation of Alternatives

A detailed evaluation will be conducted on the limited number of alternatives that remain after Task 6.

Identification and description of action-specific Federal and State of Ohio ARARs and other criteria, advisories and guidance to be used in the analysis and selection of a remedy will be provided. Alternatives will be analyzed in sufficient detail so that the remedies can be selected from a set of defined and discrete hazardous waste management approaches.

Information necessary to evaluate each alternative will be developed and used. The alternatives will be evaluated against the broad factors of effectiveness, implementability, and cost, using appropriate and more specific component measures such as protectiveness, compliance with applicable or relevant and appropriate requirements, reliability, and technical feasibility. The detailed analysis of each alternative shall include both short-term and long-term considerations for effectiveness, implementability, and cost.

2. Comparison of Alternatives

The alternatives will be compared to each other using the full array of evaluation factors appropriate at the Site.

Component measures of effectiveness will include the degree to which the alternative is protective of human health and the environment. Where health-based levels are established in applicable or relevant and appropriate requirements, they can be used to establish the minimum level of protection needed at the Site. Where levels do not exist, risk assessments can be used to help establish levels appropriate at the Site. The reliability of the remedy, including the potential need for and cost of replacement, is another important element of effectiveness. Specific measures may also include other health risks borne by the affected population, population sensitivities, and the impacts on environmental receptors. For ground water response actions, the potential for spread of the contaminant plume and the technical limits of ground water restoration are necessary measures. Another important measure of effectiveness is the degree that the mobility, toxicity, or volume of the hazardous substance, pollutant, or contaminant is reduced.

Component measures of implementability will include the technical feasibility of the alternative, the administrative feasibility of implementing the alternative, and the availability of any needed equipment, specialists or off-site capacity. Specific measures for ground water response actions will include the feasibility of providing an alternative water supply to meet current ground water needs, the potential need for ground water, the effectiveness and reliability of institutional controls.

Component measures of cost will include short-term, capital and operation costs and any long-term operation or maintenance costs. Present worth analysis may be used to compare alternatives.

Component measures will be tailored appropriately to the Site. Where the measures are likely to be important in discriminating among the alternatives, more emphasis and detail may be appropriate to assist in the selection of a remedy.

12.0 FEASIBILITY STUDY REPORT (SOW TASK 8)

A draft Feasibility Study Report will be prepared and submitted to the OEPA and the U.S. EPA for approval within 120 days after the final RI Report is submitted. The Report will include the results of SOW Tasks 6 and 7 with appropriate and relevant supporting information included in Appendices. Within thirty (30) calendar days, or such longer period as the U.S. EPA and the OEPA may establish, of receipt of any U.S. EPA and/or OEPA comments, a revised FS Report will be submitted. Revised reports will be submitted to the U.S. EPA and the OEPA within 30 days of receipt of written comments and notice of report disapproval, unless the U.S. EPA and the OEPA specify, in writing, a longer period for revision. The final Feasibility Study Report will be submitted after approval of the draft Feasibility Study Report in accordance with the Consent Order. The Feasibility Study Report will not select the preferred alternative but will provide such documentation that will allow the U.S. EPA and the OEPA to select the appropriate remedy.

13.0 PLAN TO SATISFY PERMIT REQUIREMENTS (PSPR)

All necessary permits or permissions will be obtained prior to the start of the activity requiring the permit. The following agencies or organizations will be contacted to obtain the appropriate permit(s) for investigation activities:

1. The Ohio Department of Natural Resources for any permits required for the collection of fish samples.

2. The local utility companies for permission or permits required to dig test pits or drill soil borings and monitoring wells.

3. The Ruetgers-Nease Salem, Ohio site operates under the following EPA I.D. number of generation of hazardous wastes: OHD980610018. Any hazardous wastes disposed of at permitted off-site facilities will be manifested, transported, and treated/disposed of in accordance with all applicable hazardous waste regulations.

the soil/sludge area west of Pond 7, and the fact, nature, extent and magnitude of their contaminants;

3. The fact, nature, extent and magnitude of contaminants associated with the four inch PVC wastewater pipe which runs from the Site along the railroad tracks to the WWTP.

The locations of waste characterization samples are shown on Figure 7-3.

7.2.1 Ponds 1 and 2

After excavation of Pond 1 in 1983, four soil samples were taken at the perimeter and near the bottom of the pond to evaluate the effectiveness of the remedial action. Comparison of indicator chemical concentrations before and after excavation indicated that much of the contaminated soils were removed but some contamination still remained.

Sampling will be performed to characterize the fact, nature, extent and magnitude of soil contamination in the area of Pond 1. Samples from two borings at the edge of the pond (refer to Figure 7-3) will undergo chemical analysis. Each boring will be sampled at three foot intervals to bedrock or nine feet into native soils below the estimated elevation of the pond bottom whichever is less. The elevation of the bottom of Pond 1 will be estimated as the elevation of the bottom of Pond 2, as determined by the boreholes that will be completed through Pond 2. Samples collected from the surface to the estimated elevation of the bottom of Pond 1 will be analyzed for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex and DPS in one boring, and for the same parameters plus 3,4-DCNB, dioxins/furans and CLP inorganics in the other boring. Each sample of native soils below the estimated elevation of the bottom of Pond 1 will be analyzed for CLP volatile organics plus 15 additional compounds plus mirex, kepone, photomirex, methoxychlor and DPS. Depth specific composite samples of native soils below the estimated elevation of the bottom of Pond 1 from both borings will be analyzed for CLP non-volatile organics plus a library search for 25 additional compounds.

Pond 2 will have four borings advanced within the pond perimeter at or about the pond midline (refer to Figure 7-3). Samples from three borings will undergo chemical analysis and samples from one boring will be analyzed for physical parameters. Each boring will be sampled at three foot intervals to bedrock or nine feet into native soils below the pond bottom whichever is less. Samples collected of non-native soils/sludges will be analyzed for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex, and DPS in two borings and for the same parameters plus 3,4-DCNB, dioxins/furans and CLP inorganics in the third boring. Each sample of native soils below the pond bottom will be analyzed for CLP volatile organics plus 15 additional compounds plus mirex, kepone, photomirex, methoxychlor and DPS. Depth specific composite samples of native soils below the pond bottom from the three Pond 2 chemical boreholes will be analyzed for CLP non-volatile organics plus a library search for 25 additional compounds. Samples collected for physical characterization will be analyzed for those parameters such as: soil classification, specific gravity, permeability, effective porosity, hydraulic conductivity, particle size analyses, moisture content and Atterburg Limits, which are necessary to conduct the EA, using the SPHEM and SEAM, and the FS.

7.2.2 Pond 3

The sludges in Pond 3 may vary in thickness from two to four feet and may not support heavy equipment. The pond is surrounded by a dike which has been breached in several areas. On the south side of the pond is the Conrail railroad track berm. The northern and western sides of the pond are bounded by poorly drained soils. Due to the lack of bearing capacity of the sludge within the pond, it may not be possible to sample this pond with normal heavy equipment. Therefore, a lighter soil boring rig, or a standard rig will be utilized to collect samples, as conditions permit.

Three borings for chemical analysis and one boring for physical parameters will be taken within Pond 3 (refer to Figure 7-3). The borings will extend down to bedrock or nine feet into native soil below the pond bottom, whichever is less. Samples will be taken from the borings at three foot intervals.

Samples of non-native materials will be analyzed for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex, and DPS in two borings, and for the same parameters plus 3,4-DCNB, dioxins/furans and CLP inorganics in the other boring. Each sample of native soils below the pond bottom will be analyzed for CLP volatile organics and library searches for up to 15 additional compounds plus mirex, kepone, photomirex, methoxychlor and DPS. Depth specific composite samples of native soils below the pond bottom from the three chemical boreholes within Pond 3 will be analyzed for CLP non-volatile organics plus a library search for 25 additional compounds. Samples collected for physical characterization will be analyzed for those parameters such as: soil classification, specific gravity, permeability, effective porosity, hydraulic conductivity, particle size analyses, moisture content and Atterburg Limits, which are necessary to conduct the EA, using the SPHEM and SEAM, and the FS.

7.2.3 Pond 4

Pond 4 has been covered with soil from off-site. Two borings for chemical analysis and one boring for physical parameters will be taken to obtain representative samples of the pond (Figure 7-6). These borings will extend to bedrock or nine feet into native soil below the pond bottom, whichever is less. Samples will be taken from these borings in three foot intervals. Samples of non-native soil/sludge will be analyzed for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex, and DPS in one boring, and for these parameters plus 3,4-DCNB, dioxins/furans and CLP inorganics in the other boring. Each sample of native soil below the pond bottom will be analyzed for CLP volatile organics plus 15 additional compounds plus mirex, kepone, photomirex, methoxychlor, and DPS. Depth specific composite samples of native soils from below the pond bottom from the two chemical boreholes within Pond 4 will be analyzed for CLP non-volatile organics plus a library search for 25 additional compounds. Samples collected for physical characterization will be analyzed for those parameters necessary such as: soil classification, specific gravity, permeability, effective porosity, hydraulic conductivity, particle size analysis, moisture content, and Atterburg Limits which are necessary to conduct the EA, using the SPHEM, the SEAM, and the FS.

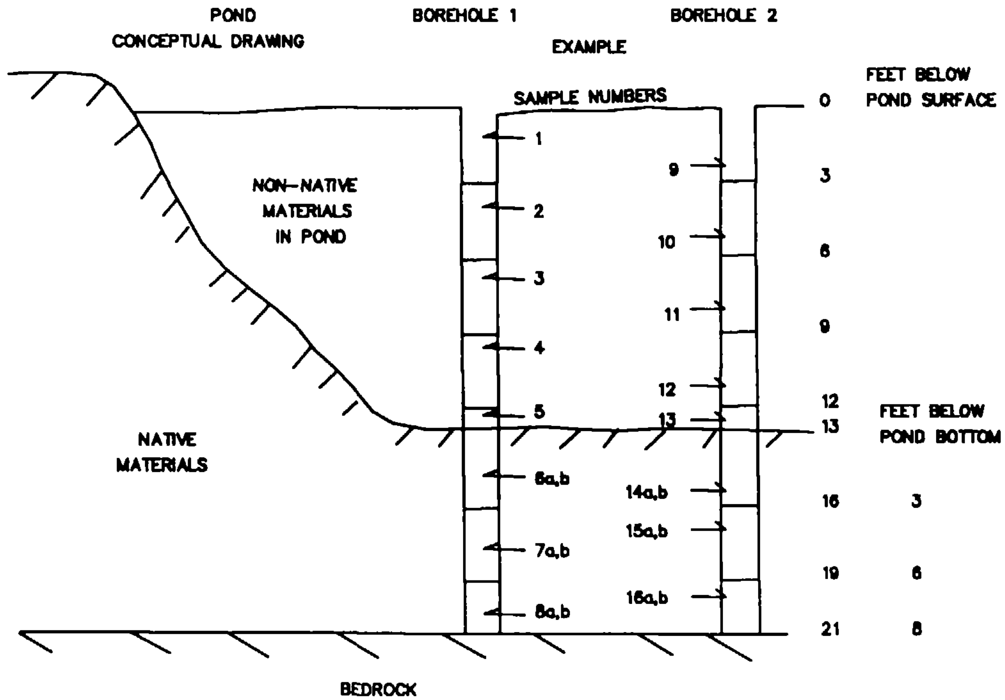
7.2.4 Pond 7 and the Soil/Sludge Area West of Pond 7

Three borings will be taken through Pond 7 and two borings will be taken through the soil/sludge area west of

FIGURE WP 7 – 6

SCHEMATIC DIAGRAM, POND SLUDGE/SOIL SAMPLING STRATEGY

RUETGERS–NEASE SALEM SITE RI/FS



SCHEDULED ANALYSIS BY
EXAMPLE SAMPLE NUMBERS

	A	B	C	D
	1	9	6a	6b+14b
	2	10	7a	7b+15b
	3	11	8a	8b+16b
	4	12	14a	
	5	13	15a	
			16a	
TOTAL SAMPLES	5	5	6	3

SCHEDULED ANALYSIS

A. CLP ORGANICS + 40 COMPOUNDS, MIREX, KEPONE, PHOTOMIREX, DPS, DCNB, DIOXINS, CLP INORGANICS

B. CLP ORGANICS + 40 COMPOUNDS, MIREX, KEPONE, PHOTOMIREX, DPS

C. CLP VOLATILE ORGANICS + 15 COMPOUNDS, MIREX, KEPONE, PHOTOMIREX, METHOXYCHLOR, DPS

D. CLP NON–VOLATILE ORGANICS + 25 COMPOUNDS

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Pond 7 (refer to Figure 7-3). Two of the Pond 7 borings and the two borings in the soil/sludge area west of Pond 7 will be for chemical analysis and one boring through Pond 7 will be taken for measurement of physical parameters. Borings will extend to bedrock or nine feet into native soil below the pond bottom or below the bottom of the sludge, whichever is less. Borings will be sampled every three feet. Samples of non-native materials will be analyzed for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex, and DPS in one boring in each area, and for these parameters plus 3,4-DCNB, dioxins/furans and CLP inorganics in the other boring in each area. Each sample of native soils below the pond bottom or below the bottom of sludge will be analyzed for CLP volatile organics plus 15 additional compounds plus mirex, kepone, photomirex, methoxychlor, and DPS. Depth specific composite samples of native soils from below the pond bottom or below the bottom of sludge from the four chemical boreholes in this area will be analyzed for CLP non-volatile organics plus a library search for 25 additional compounds. Samples collected for physical characterization will be analyzed for those parameters such as: soil classification, specific gravity, permeability, effective porosity, hydraulic conductivity, particle size analysis, moisture content, and Atterburg Limits which are necessary to conduct the EA, using the SPHEM, the SEAM, and the FS.

7.2.5 On-Site Soils

The on-site soil investigation will include the excavation of 30 test pits at locations shown on Figure 7-3. Test pits will be excavated with a backhoe and sampled in the exposed, undisturbed stratum of the pits. Sampling will be conducted in such a manner so as not to compromise the concentration of volatile compounds. Sampling will be done within three intervals: 0 to 0.5 feet BLS, 0.5 to 3.5 feet BLS and 3.5 to 6.5 feet BLS plus additional three foot cores until HNU and OVA measurements are less than 10 ppm in the top six inches of remaining subsurface soils. Samples will be collected below 9.5 feet BLS only if the water table has not been encountered.

Screening will be performed on each three-foot interval using an OVA to select the sub-interval with the highest response. This sub-interval will be taken as a grab sample and will be analyzed for CLP volatile organics and library searches for up to 15 compounds. If there are no observed differences in OVA responses between sub-intervals, the middle of the interval will be sampled as a grab and will be analyzed for CLP volatile organics and library searches for up to 15 compounds.

A composite of the entire 3-foot interval of soils will then be homogenized and analyzed for CLP non-volatile organics plus a library search for up to 25 additional compound plus mirex, kepone, photomirex, and DPS.

Samples from one test pit in Exclusion Area A, one test pit in Exclusion Area B, and from four of the remaining potentially most contaminated on-site areas will be analyzed additionally for 3,4-DCNB, dioxins/furans and CLP inorganics.

Samples from the on-site test pits will be used to determine, at a minimum, the:

1. Fact, nature, extent and magnitude of on-site soil contamination;

2. Location of contaminated soil horizons (i.e., the vertical and horizontal extent of on-site soil contamination);

3. The on-site pathways of contaminant migration.

7.2.6 Railroad Tracks

In the fall of 1986 Ruetgers-Nease excavated test pits within a 30-foot by 1,000-foot strip along the southwestern side of the Conrail tracks west of Allen Road. Soils from some pits indicated the presence of volatile organics, methoxychlor, DPS and, in a few locations, minor amounts of mirex. The four (4) inch PVC pipe used to transport treated wastewater to the Salem City Wastewater Treatment Plant still exists in this area as well as a six (6) inch PVC pipe adjacent to the Site.

A soil gas survey will be conducted along the Conrail tracks from the Site to the wastewater treatment plant. The purpose of this investigation is to define the extent of volatile organic vapors and any other contaminants that exist along the southwest side of the railroad tracks. Soil gas samples will be collected initially at 100 foot intervals along the tracks from the pond to the wastewater treatment plant. Sample probes will be inserted approximately three feet into soils, a depth which should achieve a suitable seal from the atmosphere. A Foxboro Model 128 Organic Vapor Analyzer (OVA) with a GC attachment will be used for analysis.

As the soil gas survey proceeds, several test pit locations will be chosen based on the results. The number and location of test pits along the railroad tracks will be selected through modification and approval with the OEPA/U.S.

EPA based upon the results of the soil gas survey. At least one pit will be located along the tracks next to the southern corner of the Site property. Horizontal and vertical sample point intervals within the test pits will be developed based on the results of previous test pits and the results of the soil gas survey. The soil samples collected from these test pits will be analyzed for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex, and DPS. 3,4-DCNB, dioxins/furans and CLP inorganics may be analyzed for if they are detected above background levels in on-site samples.

7.2.7 The Crane-Deming Swamp

Test pits will be dug at two locations within the Crane-Deming swamp (refer to Figure 7-3). Samples will be collected from land surface to 0.5 feet BLS, from 0.5 to 3.5 feet BLS, and for successive three foot intervals until bedrock is encountered. These samples will be analyzed for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex, and DPS. These samples are intended to quantify soil quality in the ground water discharge area.

7.3 Hydrogeologic Investigations

Hydrogeologic investigations conducted by Ruetgers-Nease have resulted in some information on the composition, geometry, hydrology and geochemistry of the hydrogeologic systems that underlie the Site and adjacent areas. Ruetgers-Nease will conduct investigative work to delineate the fact, nature, extent and magnitude of contaminants in the aquifers and to provide information to complete an RI/FS.

Ruetgers-Nease will employ varying types of geophysical surveys to investigate the hydrogeology of the study area. Figure 7-1 illustrates the location of the types of surveys to be used in this investigation. The seismic survey will be performed over an area including the Valley Fill and an eastern portion of the Site adjacent to Pond 4. Results from the seismic survey may determine the subsurface location of the bedrock in the areas surveyed. The electromagnetic conductivity survey will be performed along a segment of the MFLBC, adjacent to Exclusion Area A and along a segment of Allen Road. Results of the electromagnetic conductivity survey may be useful in determining the occurrence of contaminants within the ground water. The soil gas survey will be performed adjacent to a segment of the Conrail railroad tracks extending from the Site to the Salem Wastewater Treatment Plant, along the banks of the MFLBC, along Allen Road, and along the boundaries of the property.

Ruetgers-Nease will install at a minimum, 21 new wells at locations other than areas D, E, J, and K,and an estimated 15 wells will be installed at locations D, E, J, and K, as listed on Table 7-1 and shown on Figure 7-2. Ruetgers-Nease will collect two rounds of samples from a monitoring network consisting of all new wells and 30 of 38 existing wells (refer to Table 7-2). Water level measurements will be collected from all new and all 38 existing wells. The type of drilling method used will be consistent with U.S. EPA Guidelines. Field conditions will dictate the most appropriate method for use at specific locations although specific drilling methods will be presented in the Site-Specific Sampling Plan. Ruetgers-Nease will slug test selected monitoring wells and collect water level elevations from all monitoring wells to identify ground water flow patterns. A pump test will be conducted if the slug test results are inconclusive pursuant to the additional work provisions of Paragraph XIII of the Consent Order.

The hydrogeologic investigations which will be conducted by Ruetgers-Nease have been planned, at a minimum, to meet specific objectives for each aquifer system or area to fully delineate the fact, nature, extent and magnitude of any release or threatened release of contaminants from the Site. These objectives, at a minimum, are as follows for the Shallow Aquifer, Interface Aquifer, Upper Bedrock Aquifer, Lower Bedrock Aquifer, and the Valley Fill Aquifer:

1. Identification and quantification of the aquifers physical characteristics.

2. Identification and delineation of any ground water divide on or near the Site in the aquifers.

3. Determination and delineation of any ground water contaminant and its flow pathways and fate in each aquifer.

4. Determination and delineation of the ground water quantity and quality.

5. Determination and delineation of ground water discharge relationships between overlying and underlying aquifers and the MFLBC.

In addition, wells planned for the Interface Aquifer are intended to identify the areal extent of the Interface Aquifer.

The hydrogeologic investigations Ruetgers-Nease will conduct are described in greater detail in the following sections.

7.3.1 Shallow Aquifer

Quantification of the on-site till permeability, especially in the vicinity of the sludge ponds, will provide a better understanding of fluid and contaminant mobility in the vadose zone.

Ruetgers-Nease will use the Guelph permeameter, if approved by the Agencies, to generate vadose zone hydraulic conductivities across the Site. The Guelph permeameter is an instrument which is used to measure in-situ hydraulic conductivity above the water table. The method involves measurement of the steady-state flow rate of water into the soil from a small cylindrical hole, in which a constant head of water is maintained. An in-hole mariotte bottle device is used to establish and maintain the constant head. The hydraulic conductivity is calculated using the measured steady-state flow rate and the theoretical governing equations of flow which describe steady-state discharge from a cylindrical well into an unsaturated soil.

The permeameter is light weight and requires only one person for field operation. Measurements can be made from one-half to two hours. This method for measuring vadose zone hydraulic conductivity has been field verified.

The presence and location of any ground water divide in the Shallow Aquifer at the edges of the Site requires further mapping. Identification of a divide will indicate the potential for contaminant movement in the direction of private residences. Ruetgers-Nease will install one monitoring well screened in the Shallow Aquifer in areas A, B and C. These wells will yield water level elevations and water quality data. In addition to areas A, B and C, Ruetgers-Nease will complete Shallow Aquifer monitoring wells in areas H, I and L. Area H and L wells will complete the monitoring well network in the Shallow Aquifer by indicating if contaminants have migrated off-site in a northeasterly and southerly direction. The Area I well, based on the existing known hydraulic gradient in the Shallow Aquifer, may yield representative samples of background water quality.

7.3.2 Interface Aquifer

Ruetgers-Nease will complete one monitoring well screened in the Interface Aquifer in each of areas C, F, H, I and L to complete the investigation of the extent of the Interface Aquifer and the quality of ground water within it. In areas C, H and I the absence of the Interface Aquifer is a possibility. If the Interface Aquifer is not encountered in these areas, a well will be completed in an overlying water bearing zone if encountered at the same depth as the Interface Aquifer. A pump test may be necessary to establish any connection between this and other aquifers. This pump test would be conducted pursuant to the additional work provisions of Paragraph XIII of the Consent Order.

7.3.3 Upper Bedrock Aquifer

Hydraulic relationships between the Upper Bedrock Aquifer and the overlying aquifers in the vicinity of the Site have been investigated with a 48 hour pump test conducted by Ruetgers-Nease. A new pump test may be required if necessary to establish any connection between this and other aquifers. This pump test would be conducted pursuant to the additional work provisions of Paragraph XIII of the Consent Order. The relationship of the Upper Bedrock Aquifer to overlying aquifers in the vicinity of MFLBC is not completely known.

If Upper Bedrock Aquifer Strata is encountered at any of the planned seven monitoring well locations (refer to Table 7-1 and Figure 7-2), Ruetgers-Nease will complete an Upper Bedrock monitoring well at that location to yield water level data and water quality information.

To complete the ground water quality monitoring network in the Upper Bedrock Aquifer, Ruetgers-Nease will install wells in areas A, C, F, G, H, I, and L (unless the Upper Bedrock Aquifer unit is not present). The well in area A may provide ground water level data to better delineate flow patterns in this area. In addition, the area A well may indicate any impact the Site may have on ground water in the vicinity of the residences south of the Site. Wells in areas C, F, H, and L are intended to define the extent of ground water contamination in the aquifer. The area G well is intended to monitor the ground water discharging from the aquifer to the Valley Fill. Background water quality data for the Upper Bedrock Aquifer may be provided by the well in area I.

7.3.4 Lower Bedrock Aquifer

Ruetgers-Nease will install one well screened in the Lower Bedrock Aquifer in each of areas C, I and L. The wells in areas C and I may indicate any impact the Site may have on Lower Bedrock ground water north and south of the Site. The well in area I may indicate background Lower Bedrock Aquifer ground water quality.

Ruetgers-Nease will sample the four existing and three new wells in the Lower Bedrock Aquifer to confirm the water quality and flow direction in the aquifer.

7.3.5 Valley Fill

Previous hydrogeologic investigation has determined that contaminated ground water from the Site may flow primarily towards the MFLBC and the Valley Fill. To investigate the hydraulic characteristics of the Valley Fill in relation to the MFLBC, and the fact, nature, extent and magnitude of any contamination in this area, Ruetgers-Nease will install a series of monitoring well clusters in areas D, E, J, and K. Based on field observations, water bearing zones which provide sufficient quantities of water to indicate that the zones may be areally extensive or may be hydraulically connected to other water producing zones will be individually screened and cased. The total number of wells per cluster will be determined by the total number of water bearing zones present. It is estimated that three to four water bearing zones will be screened and sampled at each cluster by the installation of monitoring wells.

These wells may characterize the lithologies present in the vicinity of MFLBC, the discharge relationships of water bearing zones to MFLBC, and the presence of contaminants in the Valley Fill. Further work, pursuant to the additional work provisions of Paragraph XIII of the Consent Order, may be needed after these clusters are installed in the Valley Fill to fully delineate the fact, nature, extent and magnitude of any contaminant.

7.3.6 Monitoring Well Sampling

Upon completion of the proposed well installations, proper well development, and an adequate interim well/aquifer equilibration period, Ruetgers-Nease will sample all new and 30 existing wells (refer to Tables 7-1 and 7-2). Samples will be analyzed for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex, and DPS. In addition to these standard analyses, samples will be collected from the four wells identified on Table 7-2 and analyzed for 3,4-DCNB, dioxins/furans and CLP inorganics. After analysis and quality assurance of all chemical results, submission of the data, ERM's validation of the data and subsequent approval of the data by U.S. EPA Region 5 and OEPA, parameters for Round 2 may be reduced to those found above background in the first sampling round if no anomalies are observed in the sampling and analysis of the first round of sampling. This list of parameters will be submitted to the U.S. EPA and the OEPA for approval. Round 2 ground water samples will be analyzed for the parameters list. Water level measurements will be taken at all new and existing wells whenever samples are collected from wells.

7.3.7 Residential Well Sampling

As soon as possible after completion of the first two phases of the residential well survey (see Section 6.2.5), five residential wells and the Salem Country Club well will be sampled and analyzed for CLP organics plus a library search for 40 compounds plus mirex, kepone, photomirex, and DPS. 3,4-DCNB, dioxins/furans or CLP inorganics may be analyzed for in the residential wells if they are detected above background levels in the on-site samples. The results of these samples will be evaluated to determine if an expanded residential well survey needs to be conducted as soon as possible pending the review of sampling and analysis data.

7.3.8 Aquifer Testing

After the first round of samples, slug tests (i.e., volume displacement tests) will be conducted on wells at each new and old well cluster to identify the hydraulic characteristics of the aquifers. For unconfined ground water conditions the Hvorslev (1951) method or the Bouwer and Rice (1976) method will be utilized. The Cooper, Bredehoeft and Papadopulus (1970) method will be used for confined conditions. These methods will be utilized pending approval by the Agencies.

The results of the ground water monitoring and the slug tests will be evaluated to determine the need for and location of any long term pump tests that may be required to support the RI/FS and EA reports. These pump tests will be conducted pursuant to the additional work provisions of Section XIII of the Consent Order.

7.4 Surface Water, Sediment, and Fish Investigations

Ruetgers-Nease will conduct a program to fully determine the on and off-site fact, nature, extent and magnitude of contamination of surface water, sediment, and fish as well as pathways and receptors of contaminant migration, as necessary to complete an RI/FS and EA.

The objectives of the surface water, sediment, and fish investigations, at a minimum, are to fully delineate and determine the fact, nature, extent and magnitude of contaminants found in the surface waters, sediments and fish that relate to the site. The survey, at a minimum, will:

1. Identify the fact, nature, extent and magnitude of the contaminants that may have migrated off-site to surface waters and sediments;

2. Identify the concentration of those contaminants that may have migrated off of the Site as well as their locations in the various media and pathways;

3. Identify pathways of migration and the fate of those contaminants.

Previous investigations have indicated three areas of possible surface water and sediment contamination on and adjacent to the Site: the freshwater ditches that drain the Site, including Feeder Creek; the Slanker Pond and Feeder Pond; and the Middle Fork of the Little Beaver Creek. The water and sediment quality of these areas has been investigated via sampling and chemical analysis on three separate occasions by Ruetgers-Nease. The OEPA collected fish, sediment, surface water and benthic organism samples in 1985 from the MFLBC. The U.S. EPA and the OEPA collected additional fish, sediment and benthic organism samples from the MFLBC between August and November 1987. As of the fall 1987, the Ohio Department of Health has issued an advisory against eating fish on a section of the MFLBC extending from the junction of Alt. Route 14 - Allen Road downstream to Route 11 south of Lisbon.

In order to meet program objectives, Ruetgers-Nease will further sample Slanker Pond, MFLBC, and areas in Feeder Creek. Sampling locations are shown on Figures 7-4 and 7-5, and described on Table 7-3. These investigations are described in detail below.

7.4.1 Slanker Pond

Sediment samples have been collected by Ruetgers-Nease personnel from Slanker Pond, the Slanker Pond beach, and at the drainageway into the Slanker Pond. Chemical analysis detected mirex in some samples. In 1985, water samples were collected by Ruetgers-Nease from the Slanker Pond beach and from the pond that feeds Slanker Pond. No indicator compounds (Table 7-4) were detected by Ruetgers-Nease in these samples.

Ruetgers-Nease will sample surface water, sediments, and fish in the pond and surface water and sediments in the vicinity of the drainageway as shown on Figure 7-4. Slanker Pond samples will consist of:

1. One sediment sample at the point of deepest water depth and one surface water sample at the same location collected at the mid-depth of the water column.

2. One sediment sample northeast of the beach. This sample will be taken where the water is three feet deep, and away from the beach sand that was introduced into the pond to create the beach.

3. One sediment sample at the inlet/outlet area.

4. One sediment sample at the Feeder Pond, located immediately west of Slanker Pond.

5. Fish will be collected from the middle of the pond for tissue analysis.

Analysis of these samples will collectively consist of CLP organics plus a library search for 40 compounds plus mirex, kepone, photomirex, and DPS. Samples may be analyzed for 3,4-DCNB, dioxins/furans and CLP inorganics, if they are detected above background levels in on-site samples. Results will be evaluated to determine the need for further sampling in the area.

In addition, several surface water elevation measuring points will be surveyed in the Feeder and Slanker Ponds so that pond water elevations can be determined.

7.4.2 Middle Fork Little Beaver Creek

Ruetgers-Nease will take surface water, sediment, flood plain, and fish samples in the MFLBC at locations as shown on Figures 7-4 and 7-5, and as described on Table 7-3. These water, fish, soil, and sediment samples will be collectively analyzed for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex, and DPS. 3,4-DCNB, dioxins/furans and CLP inorganics may be analyzed for if they are detected above background levels in on-site samples.

The results may be used along with the results of previous Ruetgers-Nease sampling and the U.S. EPA/OEPA sampling program conducted between August and November 1987 and the results of the 1985 OEPA survey of the MFLBC to determine the need for and locations of additional surface water, sediment, and fish samples downstream of the site and the compounds that are of concern, pursuant to the additional work provisions of Paragraph XIII of the Consent Order.

7.4.3 Feeder Creek and Related Drainage Areas

Ruetgers-Nease will collect grab sediment and surface water (if present) samples at seven locations in drainage areas on-site, in the Feeder Creek and in the swale draining the Crane-Deming Swamp. These locations are shown on Figure 7-4 and described on Table 7-3. Samples will be collected, at a minimum, to fully delineate and determine the fact, nature, extent and magnitude of contaminants found in the surface water and sediment matrices.

Feeder Creek surface water and sediment samples will be analyzed for CLP organics plus a library search for 40 additional compounds plus mirex, kepone, photomirex and DPS. 3,4-DCNB, dioxins/furans and CLP inorganics may be analyzed for if they are detected above background levels in on-site samples.

7.5 Off-Site Soils Investigation

Ruetgers-Nease will conduct an off-site soils investigation to determine and delineate the fact, nature, extent and magnitude of any release of contaminants found in off-site soils. This investigation may overlap with certain aspects of the hydrogeology study (e.g., characteristics of soil horizons may be relevant to both contaminant transport by ground water and to the location of contaminants in the soil).

The objectives of the off-site soils investigation are, at a minimum, to:

1. Identify and delineate the fact, nature, extent and magnitude of the contaminants that may have migrated off-site;

2. Identify the concentration, pathways and fate of these contaminants at the land surface and at depth.

In order to meet these objectives, samples will be collected at eleven locations shown on Figure 7-4. Samples will be collected from ground level to 0.5 feet BLS, from 0.5 to 3.5 feet BLS plus additional three foot cores until HNU and OVA measurements are less than 10 ppm in the top six inches of remaining subsurface soils. Samples will be collected below 9.5 feet BLS only if the water table has not been encountered. The analysis for off-site soil samples will include CLP non-volatile organics (pesticides, acids and base/neutral fractions), a library search for 40 additional compounds plus mirex, kepone, photomirex, and DPS. 3,4,-DCNB, dioxins/furans and CLP inorganics may be analyzed for if they are detected above background levels in on-site samples.

7.6 Air Monitoring

7.6.1 Previous Monitoring Studies

In the Autumn of 1982, a US EPA Field Investigation Team conducted ambient air sampling at the Site to identify the extent of fugitive air emissions. During this sampling, air samples were collected and analyzed for the following:

1. Pesticides in suspended particulates;

2. Volatile organics in fugitive vapor emissions.

Laboratory analyses indicated no measurable pesticides leaving the Site and very little, if any volatile organics. In late 1985, Ruetgers-Nease conducted air monitoring at the Crane-Deming Plant using carbon tubes. The 1985 Crane-Deming Plant air sampling indicated no significant air contamination at that time.

7.6.2 Site Reconnaissance

Prior to initiation of any field work, Ruetgers-Nease will perform a reconnaissance organic vapor survey of the Site. Both a Foxboro OVA (FID) and an HNU P101 (PID) instrument will be utilized. The survey will identify areas with elevated levels of volatile organic compounds that may also require inclusion as an exclusion area.

Measurements of VOCs at ground surface and three feet above ground surface using the PID and FID will be made at 100 foot intervals along the site boundaries, around each pond at stations every 50 feet, and at several locations within the proposed clean support zone. The areas between discrete sampling points will be walked with the instrument operating in order to detect any unexpected elevated levels of volatile compounds. The work and exclusion zones around each pit excavation, boring or well drilling location will be screened during site work using a PID and/or FID to determine proper health and safety protection. All measurements at discrete monitoring stations will be recorded in the field log book along with location, time, and area weather conditions. Weather conditions (wind speed and direction, and temperature) will be obtained from the region's weather bureau. Wind rose data obtainable from the weather bureau will be used as a preliminary guideline to establish upwind and downwind air sampling stations.

Emphasis during the survey will be placed on locating areas registering organic vapor emission above background; background will be determined by operating the instruments upwind of the Site. Previous organic vapor surveys have not identified areas exhibiting elevated volatile organic levels.

7.6.3. Air Monitoring Objectives

The objectives of the air monitoring program are to fully delineate and determine the fact, nature, extent and magnitude of contaminants found in the air pathways. Ruetgers-Nease will collect, at a minimum, data to:

1. Establish whether volatile, non-volatile organic contaminants, and pesticides are entering the atmosphere, and their fact, nature, extent and magnitude;

2. Provide data to establish the degree of hazard;

3. Provide data to establish the influence of local wind patterns in possible contaminant transport.

Ruetgers-Nease will obtain air monitoring data for volatile and non-volatile organics, particulates, and pesticides to assist in the evaluation of remedial alternatives, and to quantify risks to the population in the vicinity of the Site for use in the EA.

7.6.4 Sampling Station Locations

Six sampling stations will be established to assess the ambient air quality upwind and downwind on off-site locations as well as to assess the "worst case" ambient air scenarios on the Site. These stations will be located at the following locations:

1. Upwind

2. Downwind

3. Adjacent to Pond 1

4. At Pond 2

5. Adjacent to Pond 7

6. Near the leachate collection system south of the railroad tracks

7.6.5 Organic Chemical and Particulate Sampling

7.6.5.1 Volatile and Semi-Volatile Compound Collection

Tenax traps and XAD-2 tubes will be utilized to collect volatile organic compounds and semi-volatile organic compounds, respectively, which may be emitted into the ambient air from the Site. Carbon molecular sieve traps will be utilized to trap highly volatile compounds. Volatiles will be collected via EPA method TO1 (Tenax) and TO2 (carbon molecular sieves). Semi-volatiles will be collected utilizing procedures described in Method TO1 but using XAD-2 resin instead of Tenax. Two EPA approved sampling trains (oilless pump plus two mass flow controllers per pump) will be utilized during this phase of the sampling. The mass flow meters will enable accurate collection of a known volume of air. Each train can collect two samples simultaneously. This will assist in the required quality assurance of the project. The volatiles and semi-volatiles will be sampled at the six preselected stations. The sampling time will be ascertained based on published retention volume data for the resin and by the Enseco laboratory validation studies. All attempts will be made to collect all samples during warm, dry, moderately calm conditions with a prevailing southwesterly wind.

These samples will be analyzed for non-volatile and volatile organics. Two samples will be collected simultaneously to allow for backup analysis. Every effort will be made to obtain samples that are representative of the ambient air present at each sampling location. Sampling tubes and pumps will be protected from wind and weather by a shelter which will allow free transport of volatile and non-volatile organics from the soil. Sample tubes at on-site locations will be placed three feet above ground, and at off-site locations will be placed five to six feet above the ground to better assess ambient breathing air quality. After sampling, appropriate chain-of-custody will be completed, the tubes will be capped, labeled, placed in cooled shipping containers, sealed, labeled, and transported to the laboratory for analysis.

7.6.5.2 Airborne Organochlorine Pesticide and PCB Compound Collection

Hi-volume air samplers which have been modified to collect organochlorine pesticides and PCBs utilizing a four-inch filter and polyurethane foam cartridge will be utilized to collect the particulate and vapor phase, if any, of organochlorine pesticides, including mirex, photomirex, and kepone, as well as PCB compounds. EPA Method TO4 will be utilized for this phase of the project. Generally, detection limits in excess of 1 ng/m^3 are achievable using a 24-hour sampling period at a flow rate of approximately 200-280 liters/minute. All sampling and calibration procedures will adhere to those described in the EPA Method TO4. Sampling for pesticides/PCBs will occur at least at the six locations previously enumerated. The samples will be taken from a height of three feet at on-site locations, and from a height of five to six feet at off-site locations to better assess any levels of pesticides/PCBs that may be present in the breathing zone.

There will be two off-site air monitoring stations, one located upwind of the site and one located downwind of the site. The prevailing winds at the site during the summer months are from the southwest. The anticipated upwind location will be approximately 300 feet southwest of the site and is designated as Air Station 1 on Figure WP 7-7. The anticipated downwind location is approximately 400 feet east-northeast of the site and is designated as Sampling Station 2 on Figure WP 7-7.

7.6.5.3 Particulate Sample Collection

Two hi-volume air samplers will be utilized for total particulate collection. This data will be utilized for developing the health risk assessment. All sampling procedures (except sampling height) will adhere to those described in the EPA method, "Determination of Suspended Particulate in the Atmosphere (High volume Method)" promulgated in #40 CFR, Part 50.11, Appendix B, July 1, 1975, pages 12-16. A sampling height of five to six feet will be utilized. Representative sampling sites will be chosen for use in the health risk assessment. Particulate matter in the atmosphere is much more area dependent than point source